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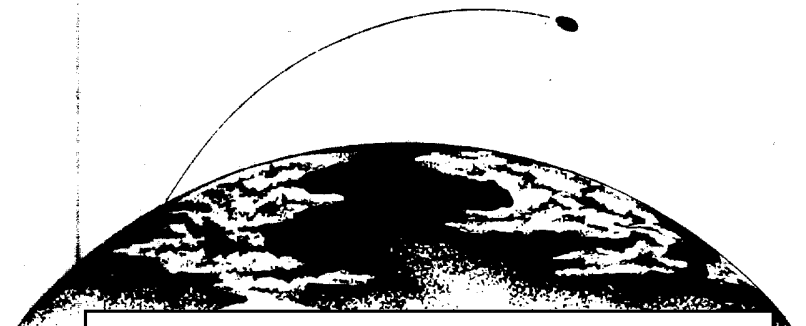
PROTOTYPE MODULATED-LIGHT FILM-VIEWING TABLE (MODEL NO. PR-3600A)

OPERATOR INSTRUCTION MANUAL

Prepared under Contract No. [redacted]

25X1



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OPERATOR INSTRUCTION MANUAL

PREPARED BY:

25X1

[redacted]

AED M-2070

ISSUED: March 1, 1967

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE OF MANUAL

1.1.1 The purpose of this manual is to provide the necessary instructions to operate and maintain the Prototype Modulated-Light Film-Viewing Table. Included in this manual are a general and functional description of the equipment, procedures for installation, and detailed operating instructions. The maintenance philosophy associated with the equipment is defined and instructions for servicing and preventive maintenance are given. Also included is a list of critical components and the pertinent diagrams and schematic drawings.

WARNING: HIGH VOLTAGES AND RADIATION HAZARDS ARE PRESENT IN THIS EQUIPMENT WHICH CONTAINS PRECISION ELECTRICAL AND MECHANICAL COMPONENTS. FULL PROTECTION IS PROVIDED FOR THE EQUIPMENT AND PERSONNEL IN THE NORMAL OPERATING MODE. THERE IS THE POTENTIAL OF INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT IF MAINTENANCE IS UNDERTAKEN BY PERSONS NOT TRAINED FOR THIS PURPOSE.

1.1.2 The prototype modulated-light film-viewing system was manufactured under [redacted] by the [redacted] 25X1 25X1 25X1 [redacted] The manufacturer identified this equipment by Model No. PR-3600A.

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2.0 DESCRIPTION

2.1 PURPOSE OF THE EQUIPMENT

2.1.1 The modulated-light film-viewing table provides a means of large-area contrast compression that is specifically designed to assist the photo-interpreter during the observation and detailed analysis of photographic film. This equipment provides a means of compressing the large-area contrasts which are encountered in viewing film because of light spilling around the edges of the film where the film may be smaller than the lit area or where an excessive amount of light is spilling through a thin-density area such as a cloud on an aerial photograph. The purpose of this equipment, therefore, is to aid the photo-interpreter to see the detail in dark areas that are adjacent to areas that are brightly lit.

2.1.2 Other operating conveniences are offered: (1) The table top is tiltable. The operator can, therefore work in more comfort. (2) The table top is rotatable. The operator can therefore examine the film in any orientation. (3) Brightness is adjustable. (4) A microscope is provided mounted on a pantograph with close mechanical tolerances so that frequent refocusing is unnecessary. (5) The area being illuminated can be restricted without the use of an opaque mask.

All of these functions are made accessible to the operator by means of knobs and switches, conveniently located on a control panel.

2.2 PHYSICAL DESCRIPTION

2.2.1 The modulated-light film viewer is contained in a desk-type console, as shown in Figure 1. The end modules hold the power supplies and electronic circuit boards. The center section contains the kinescope that provides the modulated light, the film reels, and associated film drives.

2.2.2 A microscope for viewing fine detail is suspended from a pantograph mechanism which is attached to the rear of the center section. The pantograph suspension provides maximum freedom of movement for the microscope. Movement of the microscope is smooth for both very short and long excursions.

2.3 FUNCTIONAL DESCRIPTION

To aid the following discussion, a block diagram of the modulated-light film-viewing table is given in Figure 2.

2.3.1 Film Transport

This equipment has the capability of handling film up to nine inches wide on reels up to 7-5/8 inches in

Figure 1. Modulated-Light Film-Viewing Table

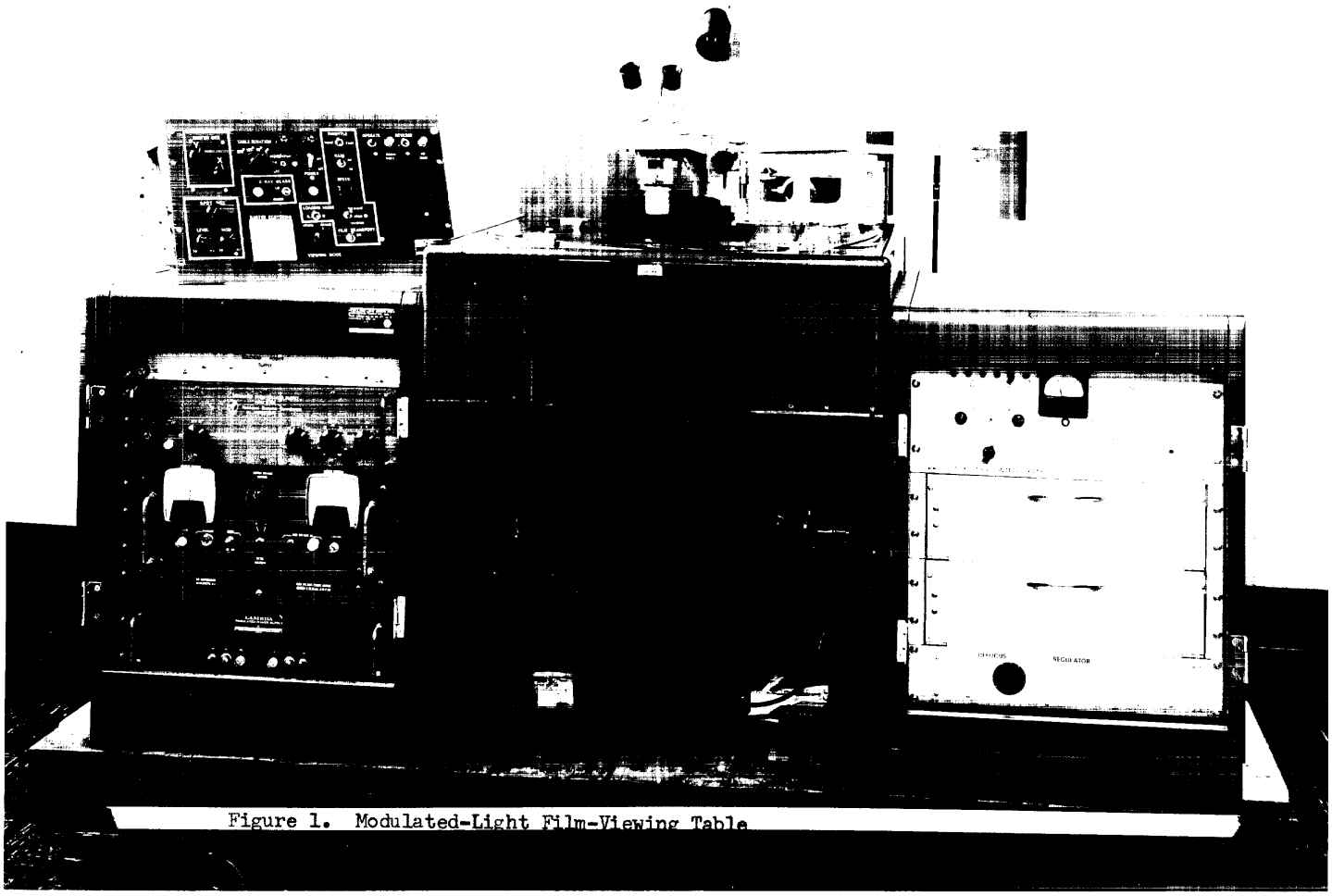

Figure 1. Modulated-Light Film-Viewing Table

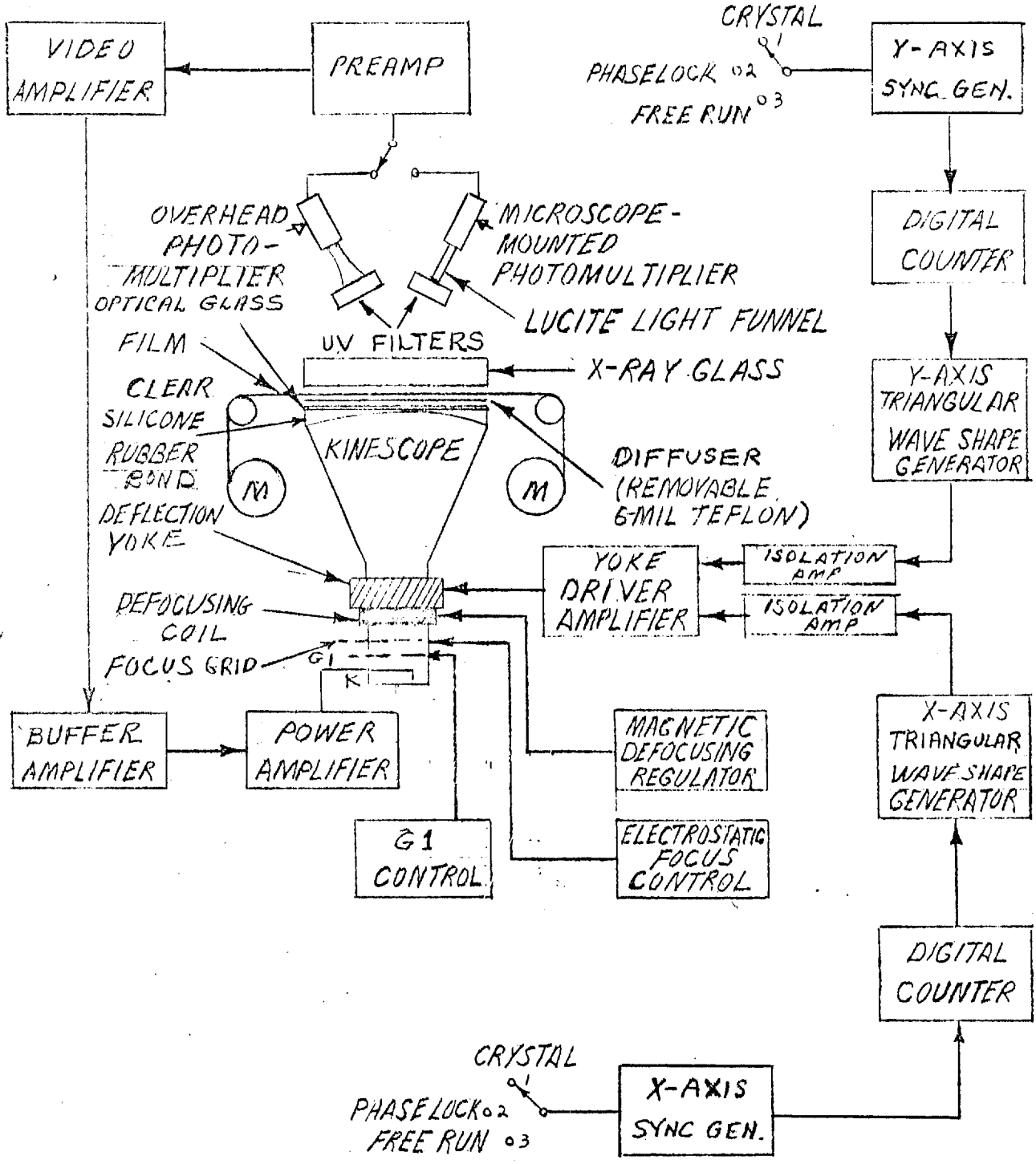

FIGURE 2. SYSTEM BLOCK DIAGRAM

diameter. The film travels over the kinescope faceplate and underneath a glass cover plate but above the diffuser. The film can be transported in either the forward or the reverse direction, at the option of the operator. Film may be loaded with the emulsion side down or up.

The film-drive mechanisms are capable of running at speeds ranging to 18 inches per second. Speed control is continuous within this range.

2.3.2 Glass Cover Plate

The glass cover plate serves three purposes: (1) it protects the kinescope faceplate, (2) it provides an X-ray shield for the operator, and (3) it flattens the film, thereby permitting better focussing of the microscope. The glass cover plate must be raised when the film is being transported. When the film transport stops, the cover plate is dropped back onto the film. Since the cover plate also serves as a safety plate, as mentioned above, a safety interlock has been provided so that when the cover plate is lifted for film loading, the kinescope high-voltage automatically shuts down, removing light and eliminating the X-ray hazard.

CAUTION: AT NO TIME SHOULD FILM BE CUT ON
THE SENSITIVE KINESCOPE FACEPLATE

2.3.3 Marking Surface

Since the operator can neither touch, write on, or cut the film during operation of the film viewer, however, a small area, 9 inches by 3 inches, has been provided where marking or measuring may be safely performed. This marking surface is illuminated from underneath by a fluorescent tube and does not have modulated illumination.

2.3.4 Illumination Area

The size of the modulated illumination area is 9-1/2 by 12 inches. The X- and Y-axis dimensions of this area are independently variable, and the X-Y position of a reduced raster can be placed anywhere within the 9-1/2 by 12-inch full-scan area. When using the overhead pickup device, (optical pickup devices are described in Paragraph 2.3.7) the reduced raster area will follow the X-Y axis motion of the microscope.

2.3.5 Light Source

The light source consists of a scanning spot in a kinescope. The light that is transmitted through the film to the photo-multiplier contains the information as to the density of the film. This information is amplified and applied as negative feedback modulation to the kinescope so that in areas of heavy density the illumination is increased and in areas of thin density the illumination is decreased. In this way, the overall contrast of the film for broad areas, as seen by the observer, is reduced.

The amount of modulation (the system closed loop gain) is controlled by the operator. Contrast compression will be approximately 30-to-1 at maximum modulation. The brightness level can also be controlled by the operator, however, the highlight compression ratio is inversily proportional to the brightness level.

At the surface of the optical glass bonded to the kinescope the spot of light used for illumination can be focused to less than 50 mils. Reduction of the spot size is limited by the fact that the light is generated in the kine phosphor, which is not in the same plane as the film. Therefore, to avoid parallax effects from occuring between the image on the film and the image on the phosphor, a retractable 5-mil-thick mylar diffuser is employed on the faceplate of the kinescope, underneath the film. Consequently, even if a small spot is made at the plane of the phosphor the spot will spread to nearly 80 mils at the plane of the film.

In addition, the console provides additional defocusing control. By turning the defocusing regulator to its maximum clockwise position spot sizes in excess of 400 mils at the plane of the deffuser can be obtained.

At the edges of the raster, the spot size is somewhat larger because the film is a plane, whereas the phosphor is on the inside of a spherical surface having a radius of curvature of about 140 inches.

At the option of the operator, the diffuser may be rolled aside and he can then view the film with a smaller spot size. However, it should be noted that he may then encounter parallax problems. This mode of operation is intended principally for viewing with a microscope.

The spot of light is deflected by two orthogonal triangular waveforms, forming an isotropic or "box-scan" pattern. The frequencies of the triangular deflecting waveforms are 10,560 and 10,500 Hertz in the "phase-lock" mode. This gives a pattern having 176 by 176 intersection points. These numbers result from dividing the scanning frequencies by their largest common denominator, namely 60. The pattern is scanned 60 frames per second, which is the difference frequency between the two. In the "crystal mode" of operation the scanning frequencies are 10,500 Hertz and 10,620 Hertz. These particular frequencies add one additional line and increase the frame rate to 120 Hertz. The isotropic scan was used for the reason that a particular area on the film is scanned from four different directions, thus avoiding trailing-edge effects.

2.3.6 Microscope

25X1 A [redacted] 7X-to-30X Stereozoom microscope is used to view small areas and fine detail. The microscope is suspended on a pantograph mechanism which is mounted on the tiltable center

section of the table. The pantograph suspension permits maximum freedom of movement for the microscope over the illuminated area.

CAUTION: AS WITH ALL PRECISION INSTRUMENTS, THE MICROSCOPE AND PANTAGRAPH SHOULD BE HANDLED WITH CARE TO AVOID DAMAGE TO JEWELED BEARINGS, ETC.

2.3.7 Optical Pickup

Optical pickup for the feedback system is accomplished by directing the modulated light to the photomultipliers. If the entire area is to be viewed, the raster illumination is detected by a photomultiplier mounted on the map holder. If the fine detail in a small area is to be viewed by the microscope, a Lucite funnel directs the raster illumination from the vertical illuminator to a photomultiplier attached to the microscope. In either case, only the ultraviolet component of the illuminating raster is detected by the video system.

2.3.8 Both photomultipliers occupy housings which contain the necessary voltage divider strings to provide the proper dynode voltages for the photomultipliers and a solid-state preamplifier. The output of the preamplifier is fed by a coaxial cable into a video amplifier which is located on the kinescope lead shield.

The video amplifier then amplifies the signal derived from the photomultiplier and the output of the video amplifier drives the kinescope cathode. The total excursion possible is sixty volts peak-to-peak, video drive.

2.3.9 Table Motion

The center section of the console is electrically tiltable to any desired elevation from 0 to 55°.

The kinescope housing can be rotated ±180°. A mechanical stop is positioned at +45° with respect to the X-axis.

2.4 GENERAL DESCRIPTION OF MAJOR COMPONENTS

2.4.1 Picture Tube

The picture tube is a sixteen-inch magnetically deflected kinescope manufactured by The Rauland Corporation, Chicago, Ill., Model No. R6110P-4. The tube is contained in an aluminized round metal envelope. The face of the tube is nearly flat having a 140-inch radius of curvature.

It is important that the distance from the microscope to the object (in this case the photographic film) be constant over the full viewing area to ensure that the microscope is always in focus. Therefore, to achieve maximum flatness of the illuminating surface, a 1/32-inch thick optical glass was bonded to the

kinescope faceplate. Since the microscope is fixed to a pantograph mechanism that does not flex significantly in the Z-axis, and since the film is held flat on the X-Y plane, the focus of the microscope is always maintained over the entire illuminated area.

2.4.2 Voltage-to-Current Converter

The voltage-to-current converters are purchased items. These units, requiring no special synthesized networks, convert an applied voltage waveform to an equivalent current waveform with a maximum gain of two. The independent X-axis and Y-axis systems operate in push-pull low-inductance driving yokes. The yokes are special in that they are prepared to produce a 9 by 12 inch raster at 30 kV and a deflection angle of 53°C.

2.4.3 Power Supplies

All power supplies used in the modulated-light film-viewing table are commercially available. Manufacturers literature is provided in Appendix B.

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3.0 INSTALLATION

3.1 SELECTION OF AREA

3.1.1 The table should be installed in an area with dimensions of at least 8 by 8 feet. The equipment occupies a floor space with dimensions of 73 by 36 inches. Clearance must be allowed for access to the equipment from both the front and the rear, and clearance must be provided for the operator's chair.

3.1.2 A source of 110-volt, 60-Hertz, single-phase power with ground is required.

3.1.3 The video system of the modulated light viewing table detects the ultraviolet component of light from the raster. Any bright light emitting an ultraviolet component of light that is within the view of the photomultipliers will be interpreted as a modulated signal and reduce the effectiveness of the video system. Therefore, anti-ultraviolet shields must cover all roomlights that will effect the operation of the film-viewing table.

3.2 PREPARATION OF EQUIPMENT FOR INSTALLATION

3.2.1 Handle all equipment with care. Any jolt may cause damage to the kinescope, the pantographs, or the light pickup devices. The equipment may rolled on the skid casters of the combination may be lifted with a fork lift to place in position.

NOTE: The equipment weighs approximately 1000 pounds and the skid weighs approximately 150 pounds.

3.2.2 Remove skid by removing straps over the center channel of the base in each of the pedestal cabinets. The bolts for these straps are accessible through the rear door in each pedestal.

3.2.3 Avoid twisting the pedestals when the table is removed from the skids.

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4.0 OPERATION

4.1 PREPARATION FOR USE

All that is necessary to prepare the equipment for use is to load the film onto the film reels. The following paragraphs describe this procedure.

CAUTION: BEFORE LOADING THE FILM, THE TABLE MUST BE IN THE HORIZONTAL POSITION. A LOADED REEL PLACES A SUBSTANTIAL UNBALANCE ON THE ROTATING CAGE. ALTHOUGH THERE IS A POSITIVE BRAKE TO PREVENT MOTION, INJURY MAY RESULT IF THIS FAILS WHEN THE OPERATORS HANDS ARE IN THE LOADING COMPARTMENT.

4.1.1 Rotate the table assembly, by releasing the hand brake, such that a film reel holder aligns with the front access port. Lock into position with the hand brake.

4.1.2 Manually lift the X-ray glass (cover plate) and fasten it to the "up" position.

NOTE: In the event that the POWER switch is in the "on" position, high-voltage to the kinescope will be automatically cut off when the X-ray glass is raised.

4.1.3 Open the console face door.

4.1.4 Press the clutch arm (painted red) toward the vertical center line of the table until the tapered center is retracted into its housing.

4.1.5 Insert the full reel into position and engage the tapered center by moving the clutch arm away from the vertical center line. Rotate the reel by hand until the shaft key engages.

4.1.6 Draw sufficient film over upper roller guide (on top of turntable assembly), to reach over the face of the tube and into the vicinity of the adjacent reel nest.

4.1.7 Lower Cover Plate.

4.1.8 Rotate table 180° and lock with brake.

4.1.9 Draw film over the upper roller guide and down toward the cavity for the empty take-up reel.

4.1.10 Thread film into the take-up reel

4.1.11 Press clutch handle (painted red) toward the vertical centerline of the table and insert reel into position.

4.1.12 Engage the clutch arm by moving handle away from the vertical centerline of the table. Rotate the reel by hand until the shaft key engages.

NOTE: The film may be loaded to view either the emulsion side or the base film uncoated side depending on whether the reel unwinds in a clockwise or counter-clockwise rotation. Note - Both reels should be threaded in the same manner. The LOADING MODE switch on the control panel will permit the transport DIRECTION switch to operate in the normal fashion if both reels are threaded in the same way.

4.1.13 Close console face door.

4.1.14 Lower the X-ray glass cover plate.

4.2 PURPOSE AND USE OF ALL OPERATING CONTROLS

All of the controls required to operate the modulated-light film-viewing table are located on one control panel, shown in Figure 4. In the paragraphs that follow equipment

controls are described in terms of equipment functions. At the end of Paragraph 4.2 the equipment controls are summarized in tabular form.

4.2.1 Equipment "Turn-on" and "Turn-off"

To start the equipment, the POWER switch, located in the center of the control panel, is moved to the "on" position. The red indicator lamp, located below the switch, will light indicating that a-c line power is being delivered to the equipment.

To turn off the equipment at the end of operation, the POWER switch is moved to the "off" position.

NOTE: There are several options for "turn-off". These options are described in detail in Paragraph 4.4.

4.2.2 Position of X-ray Glass

The position of the X-ray glass is controlled by means of the X-RAY GLASS switch. This switch has two positions: "up" and "down". When the X-ray glass is in the "up" position, the GLASS UP indicator lamp will light and stay lit until the glass is returned to the "down" position. The glass must be in the "up" position to transport film. When returned to the "down" position it holds the film flat against the kinescope faceplate. The "up" position is normal for use in viewing moving film, the "down" position is normal for use in viewing with the microscope.

CAUTION: AT NO TIME SHOULD FILM BE CUT ON THE SENSITIVE KINESCOPE FACEPLATE.

4.2.3 Film-Drive Equipment

The film-drive equipment is activated by setting the TRANSPORT switch to the "on" position and by setting the X-ray glass switch to the "up" position.

The control mode, "hand" or "foot", is selected by setting the CONTROL SELECT switch to the desired position.

The direction of film drive is controlled by the DIRECTION switch. The top and bottom settings for this switch are "forward" and "reverse" respectively. However, a third setting, "stop", is also available. The DIRECTION switch is moved to the "stop" position to halt the motion of the film in either direction.

Tape motion can be set for either rapid or slow travel by means of the SPEED RANGE switch. The "high" speed range is intended primarily for film rewinding or rapid access. The "low" speed range is intended for film viewing.

Fine adjustment can be obtained within either of these ranges by means of the SPEED ADJUST knob.

CAUTION: ABRUPT REVERSAL OF FILM DIRECTION OR ABRUPT STOPPING MAY CAUSE DAMAGE TO THE FILM AND/OR DRIVE MOTORS. CONSEQUENTLY A REDUCTION IN SPEED USING THE SPEED ADJUST KNOB IS RECOMMENDED WHEN IT IS DESIRED TO STOP OR REVERSE THE DIRECTION OF FILM DRIVE.

4.2.4 Selection of Viewing Mode

The knob marked MODULATION serves to adjust the amount of electronic signal negatively fed back to the kinescope, which determines the degree of contrast compression for modulated light viewing.

Two modulated light viewing modes are possible with this equipment: "microscope" and "direct". The viewing mode is selected by setting the switch marked VIEWING MODE into the appropriate position.

Modulation may be totally removed or returned without changing the setting of the modulation control by setting the MODULATION "OFF-ON" switch to the appropriate position.

4.2.5 Adjustment of Raster

The raster size may be adjusted in the X-axis, which is in the long dimension of the rectangular viewing area, by turning the knob marked X-AXIS. The raster size may be adjusted in the Y-axis, which is the short dimension of the rectangular viewing area, by turning the knob marked Y-AXIS. The size of the raster can be reduced from a 9-by 12-inch pattern to a 1-by 1-inch pattern.

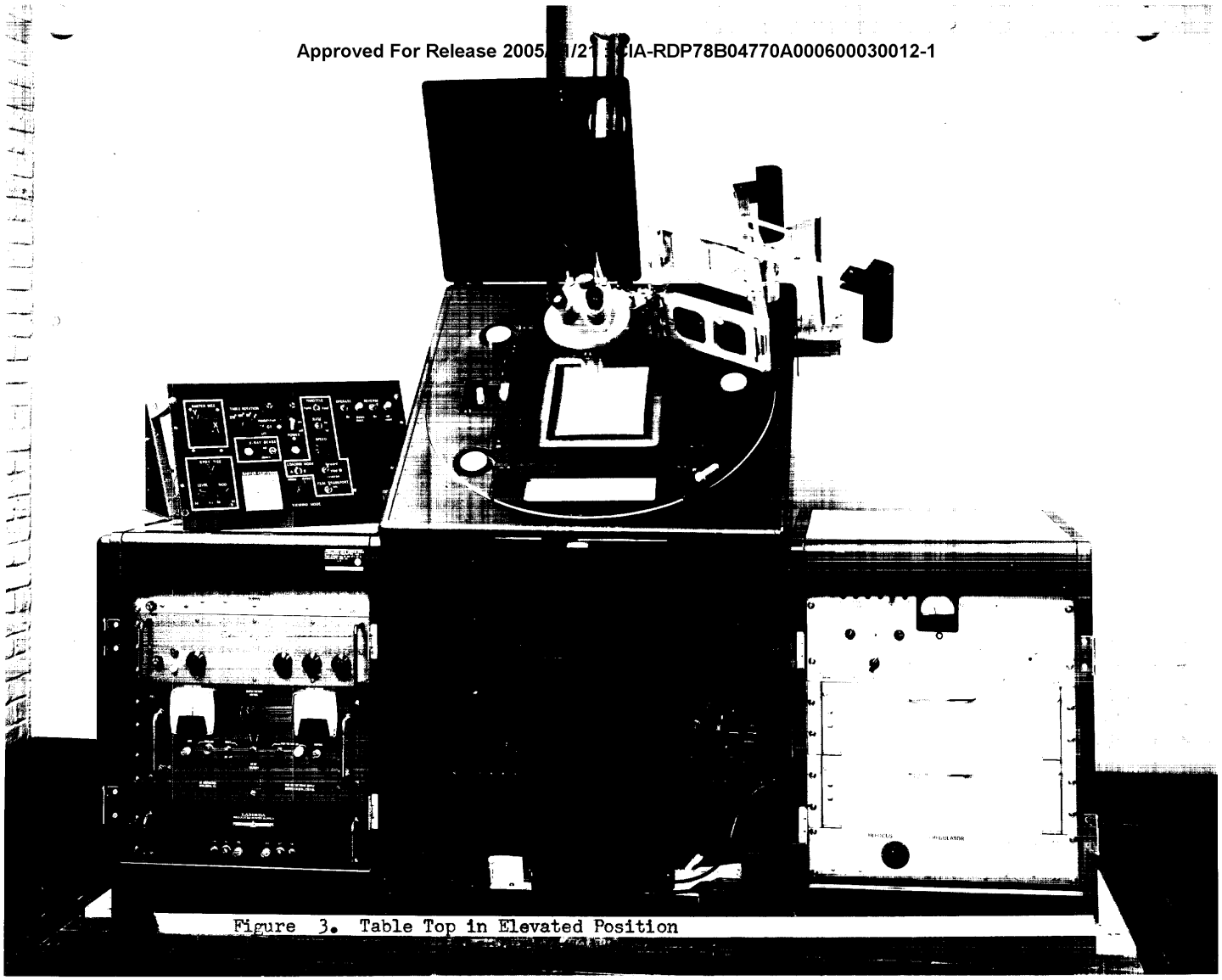

Figure 3. Table Top in Elevated Position

Positioning of the raster is controlled by means of the "joy-stick" device marked X-Y CENTERING.

A TABLE ROTATION switch enables approximate X- and Y-axis orientation to be maintained when the table is rotated.

4.2.6 Level Control

The knob marked Level Control serves to adjust the DC pedestal of the video servo system, thereby changing the intensity of the illuminating raster.

4.2.7 Defocus Control

To achieve distinct vision the kinescope spot size is varied by adjusting the defocus variac located in the right-hand console. Fine beam control is accomplished by adjusting the SPOT SIZE control.

4.2.8 Position of the Table Top

To raise or lower the table top, the DIRECTION switch must be set at the appropriate position. When the OPERATE button is depressed, the table top will move in the indicated direction. When the table top has been raised to its maximum angle (55°) as shown in Figure 3, the lamp marked UPPER LIMIT will light. When the table top is lowered to the horizontal position, its lowest position, the lamp marked LOWER LIMIT will light.

4.2.9 Rotation of the Table Top

To rotate the table, release the brake and rotate to the desired orientation with the knobs provided for this purpose on the table top. Since there is no torque compensation for the film, a substantial unbalance may occur when a fully loaded reel is rotated to certain positions. For this reason the knobs should always be grasped firmly before the brake is released and the brake should be released slowly to provide braking control. The brake is positive locking to prevent an accidental unlocking when in an unbalanced condition.

4.2.10 Open Loop Brightness

When the video system is operated open-loop i.e. modulation "OFF" the kinescope raster illumination is controlled by this potentiometer.

TABLE 4-1. CONTROLS AND THEIR FUNCTIONS

CONTROL	FUNCTION
POWER	
Switch	Turns equipment "on" and "off".
Lamp	Indicates that power is "on".
X-RAY GLASS	
Switch	Lifts X-ray glass "up" or "down".
GLASS UP Lamp	Indicates that glass is in "up" position.
FILM TRANSPORT	
TRANSPORT (Switch)	Turns transport "on" and "off".
CONTROL SELECT (Switch)	Selector for "hand" or "foot" operation.
DIRECTION (Switch)	Selector for film motion: "forward", "stop", and "reverse".
SPEED RANGE (Switch)	Selector for rate of film travel. "High" indicates the fast rate, "Low" indicates the slow rate.
SPEED ADJUST (Knob)	To adjust the speed within the selected speed range.
LOADING MODE (Switch)	Selects direction of reel rotation so that reels may be wound and unwound from top or bottom.

TABLE 4-1. CONTROLS AND THEIR FUNCTIONS (continued)

CONTROL	FUNCTION
VIEWING MODE (Switch)	Selector for method of viewing: "Microscope" or "Direct".
RASTER SIZE	
X-AXIS (Knob)	To adjust raster in X-axis, long dimension of rectangular viewing area.
Y-AXIS (Knob)	To adjust raster in Y-axis, short dimension of rectangular viewing area.
RASTER CENTERING	Controls position of raster in "direct" viewing mode only. In "micro" viewing mode raster position is automatic.
TABLE ROTATION (Switch)	Allows X-Y positioning from the same reference direction for four different positions of table rotation ("0°", "90°", "180°", "270°").
LEVEL	To adjust brightness

TABLE 4-1. CONTROLS AND THEIR FUNCTIONS (continued)

CONTROL	FUNCTION
MODULATION	To adjust modulation.
SPOT SIZE	To adjust focus.
DEFOCUS REGULATOR	To adjust focus.
OPEN LOOP BRIGHTNESS	Adjust kinescope illumination when modulation is turned off.

4.3 STARTING THE EQUIPMENT

The power is moved to the "on" position. The red indicator lamp immediately below the power will light at this time and stay lit as long as power is being delivered to the system. A 10-minute warm-up period is recommended to allow the electronics to stabilize. (An automatic 60 second delay period is built in.) However, if necessary, the equipment may be operated as soon as the raster is visible on the tube, although for a brief period equipment performance may not be optimum.

4.4 OPERATION OF THE EQUIPMENT

4.4.1 Operation of the Film Drive Equipment

The film-drive equipment is activated by turning the TRANSPORT switch to the "on" position. Note the position of the X-ray glass. This will be indicated by the X-RAY GLASS lamp, which lights whenever the glass is lifted. The film transport will not operate except when the X-ray glass is lifted.

Set the film drive DIRECTION switch in "forward" or "reverse", as desired and the film SPEED RANGE in the "high" or "low" speed, as desired. The "high" speed range is intended for film rewinding or rapid access. The "low" speed range is intended for film viewing. Set LOADING MODE switch in "A" or "B" position depending on whether the film is loaded to pass over the top of the

reels or from the bottom (emulsion side up or down). Fine speed adjustment within the available ranges is controlled with the SPEED ADJUST knob.

4.4.2 Stopping the Film

There are three methods of stopping the film in the course of normal operation: (a) Move the DIRECTION switch to the "STOP" position, (b) Move the TRANSPORT switch to the "off" position or (c). When operating in the low range, the film can be stopped by moving the SPEED ADJUST knob to the lower limit of the range.

CAUTION: ABRUPT REVERSAL OF FILM DIRECTION OR ABRUPT STOPPING MAY CAUSE DAMAGE TO THE FILM AND/OR DRIVE MOTORS. CONSEQUENTLY, A REDUCTION IN SPEED USING THE SPEED ADJUST KNOB IS RECOMMENDED WHEN IT IS DESIRED TO STOP OR REVERSE THE DIRECTION OF FILM MOTION.

4.4.3 Viewing the Film

Once the film is stopped, the X-ray glass may be lowered by moving the X-RAY GLASS switch to the "down" position.

The raster size in the X-axis, the long dimension of the rectangular viewing area, is controlled by the X-AXIS knob.

The raster size in the Y-axis, the short dimension of the rectangular viewing area, is controlled by the Y-AXIS knob. With the VIEWING MODE selection switch set in the "direct" mode, the position of the raster is controlled by the X-Y CENTERING "joy-stick". With the VIEWING MODE selection switch set in the "microscope" mode, the position of the raster is controlled by the position of the microscope.

Brightness of the illumination is set by the LEVEL control. Brightness should be set to the amount of illumination desired in the thin or less-dense areas of the film.

Control of the amount of modulation is achieved by the MODULATION control. A modulation "On-Off" switch is provided to permit the modulation to be removed entirely without changing the setting of the MODULATION control.

It will be noted that when using modulated light, obstruction of the light path between the illuminated area and the pickup will serve to cause a local brightening of the illumination in the obstructed area. This feature may prove useful in operation if the operator wishes to brighten a particular area more than it would normally be brightened in normal operation.

The TABLE ROTATE switch is provided to reorientate the raster direction when the viewing table is rotated so that the X-and Y-axis directions can be approximately maintained for positioning and raster size control.

The CENTERING and RASTER SIZE controls enable masking of any portion of the film without using tape or external masks.

4.4.4 Positioning the Diffuser

When the viewer is in the "direct" viewing mode, the retractable Mylar diffuser should completely cover the viewing area to eliminate parallax effects. When microscope viewing is desired the diffuser is normally removed from the viewing area.

Two diffuser positioning handles, mounted on the console table top, are locked into place by detents. To cover the viewing area lift both handles from their respective detents and rotate handle "C" in the direction indicated. (Maintain counter pressure on handle "O" while covering the viewing area.) To remove the diffuser lift both handles from their respective detants and rotate handle "O" in the direction indicated. (Once again, maintain counter pressure on handle "C" while uncovering the viewing area.)

CAUTION: BE SURE HANDLES ARE PLACED BACK INTO THE DETENTS AFTER EITHER COVERING OR UNCOVERING THE VIEWING AREA.

4.4.5 Manual Film Transport

The film to be viewed may either be advanced automatically or manually. Two identical knurled knobs, located at each end of the viewing area are the film manual advancing controls. To advance the film in a specific direction select the control that corresponds to that direction. Press down and rotate this control until it engages the transport gearing. Once the transport gearing is engaged the X-ray safety glass will automatically lift allowing the film to be manually advanced to the desired distance. When completed disengage the control.

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5.0 MAINTENANCE LIMITATIONS

User maintenance on the modulated-light film-viewing table is limited to these operations that are required to keep the equipment in good operating condition. All other repair and replacement operations should not be undertaken by other than qualified personnel.

WARNING: BE SURE THAT POWER IS OFF BEFORE OPENING ANY CABINET DOOR. DO NOT DEFEAT ANY INTERLOCK SWITCH. HIGH VOLTAGES PRESENT IN THE CABINETS CAN CAUSE INJURY OR DEATH.

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APPENDIX A

CIRCUITS

A.1 VIDEO SYSTEM

The video system, shown in Figure A-1, detects the modulation of the light passing through the viewed film as it is swept by the beam which produces the illuminated raster on the kinescope face. This modulation signal is amplified in the photomultiplier and Nuvistor preamplifier, in either of two light pick up devices (one on the microscope and one on the map board). Additional amplification is accomplished in the rest of the video system and the processed signal is applied to the cathode of the kinescope. The application of the light modulation produces an increase in gamma in the viewed negative.

A.1.1 Photomultiplier Preamplifier

Two photomultiplier and solid-state preamplifiers, shown in Figure A-2, are used in the video system. One is used in the microscope light pick up and one is used in the map board light pickup to provide low noise amplification of the modulation of the light which passes through the film as it is scanned.

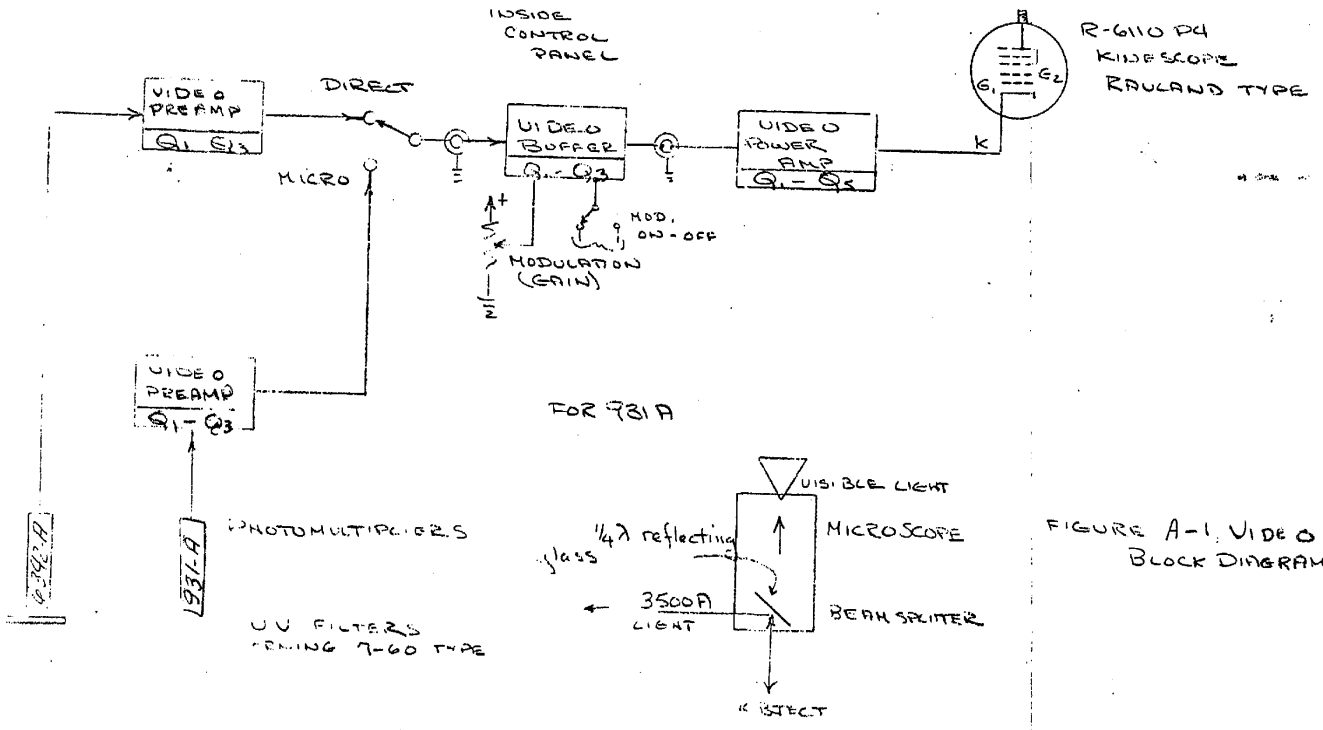


FIGURE A-1 VIDEO SYSTEM BLOCK DIAGRAM

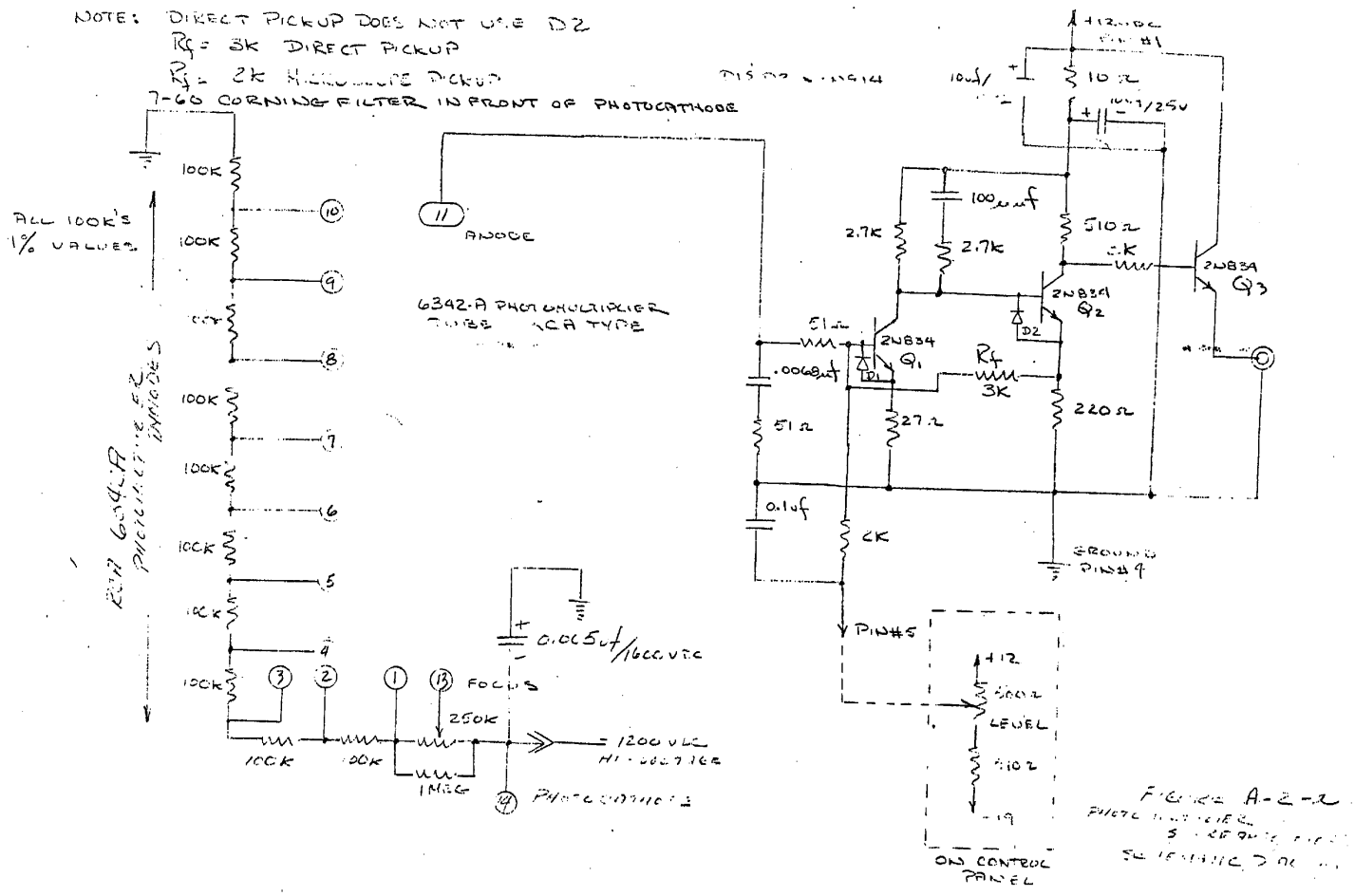


FIGURE A-2-2

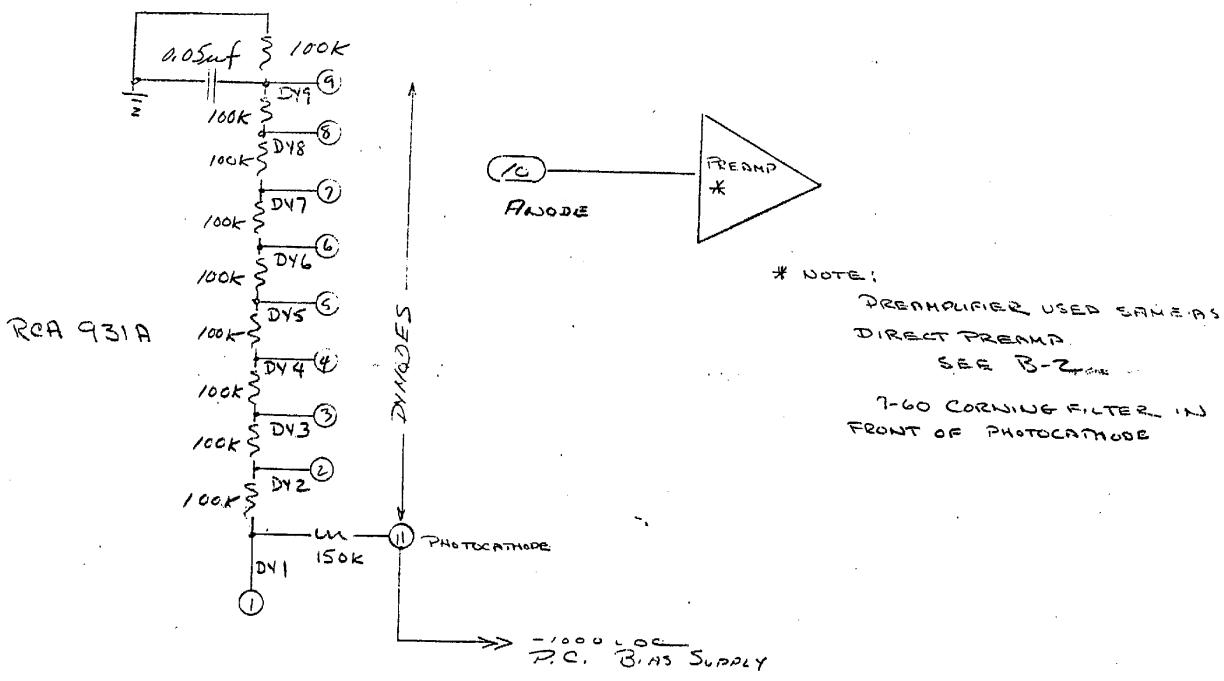


FIGURE A-2-b

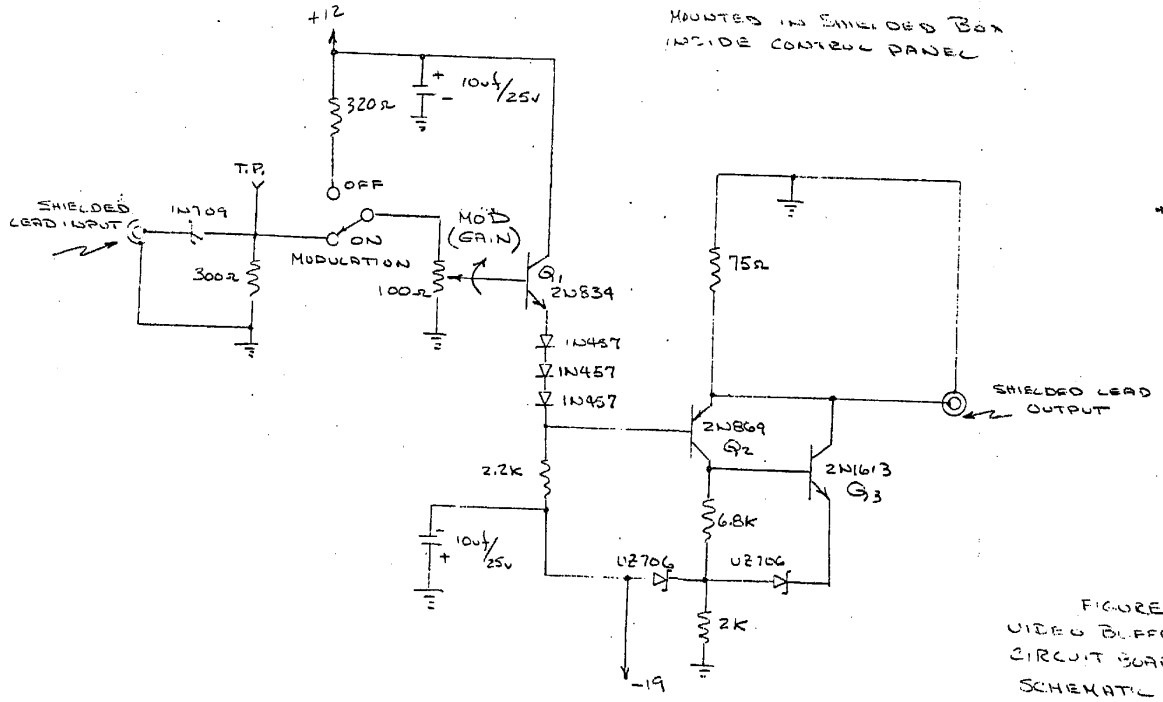


FIGURE A-5
VIDEO BUFFER AMPLIFIER CIRCUIT BOARD PRINT
SCHEMATIC DIAGRAM

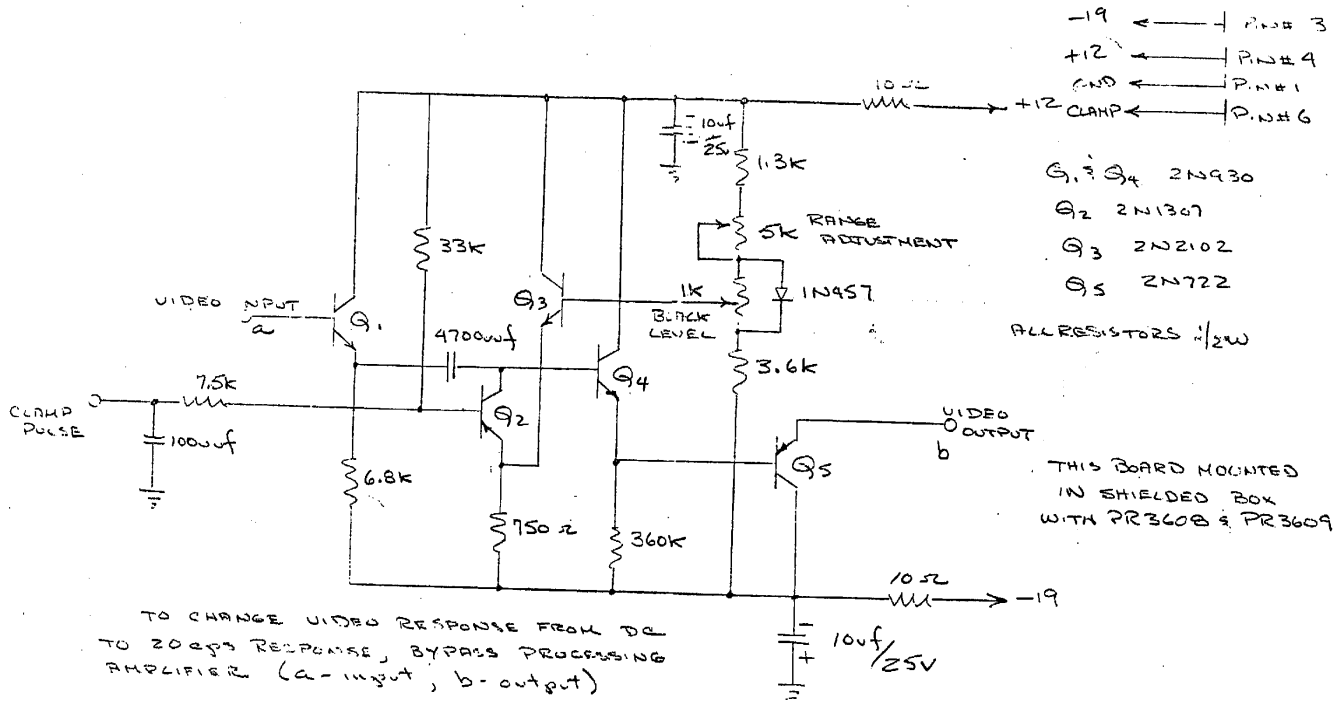


FIGURE A-4, VIDEO PROCESSOR CIRCUIT BOARD PR3614, SCHEMATIC DIAGRAM

A.1.2 Video Buffer Amplifier

The video buffer amplifier circuit board, shown in Figure A-3, is contained, in a shielded box within the control panel. This amplifier provides gain control (modulation control) as well as proper DC interfacing between the preamplifier and power amplifier.

A.1.3 Video Processor

The video processer circuit board, shown in Figure A-4, is mounted in a shielded box with both the video preamplifier and the video power amplifier. The video processing amplifier inserts a clamp pulse from the X-axis synchronous system in the video signal and allows the black level of the signal to be adjusted. The clamp pulse, which is added at both edges of the X-axis scanning signal waveform, allows the charge on the final capacitor in the video amplification chain to be replenished thereby establishing bias on the kinescope cathode at both edges of the X-axis trace. Video clamping essentially shifts the video band-pass frequencies lower to include d.c.

A.1.4 Video Power Amplifier

The video power amplifier circuit board, shown in Figure A-5, is contained in a shielded box. The processed video signal is amplified by this amplifier and applied directly to the cathode of the kinescope. Current feedback is employed to linearize the response of the amplifier.

A.2 X- AND Y-AXIS SYNCHRONOUS SYSTEMS

The X- and Y-axis synchronous systems, shown in Figures A-6 and A-7, are independent timing networks that generate, shape, clamp, and arrange in proper sequence all the pulses necessary to control the isotropic scanning mode of illumination of the modulated-light film viewer.

The sync units develop a Y-axis frequency component of 10.50 kilohertz and an X-axis frequency component of either 10.56 or 10.62 kilohertz. These two primary frequencies produce an illuminating raster on the kinescope with a 176 by 175 line pattern or a 177 by 175 line pattern skewed 45 degrees with respect to the Y-axis.

The synchronizing generators must develop and control the following voltage pulse waveforms:

(1) A Y-axis (vertical) driving pulse at a frequency of 10.50 kilohertz.

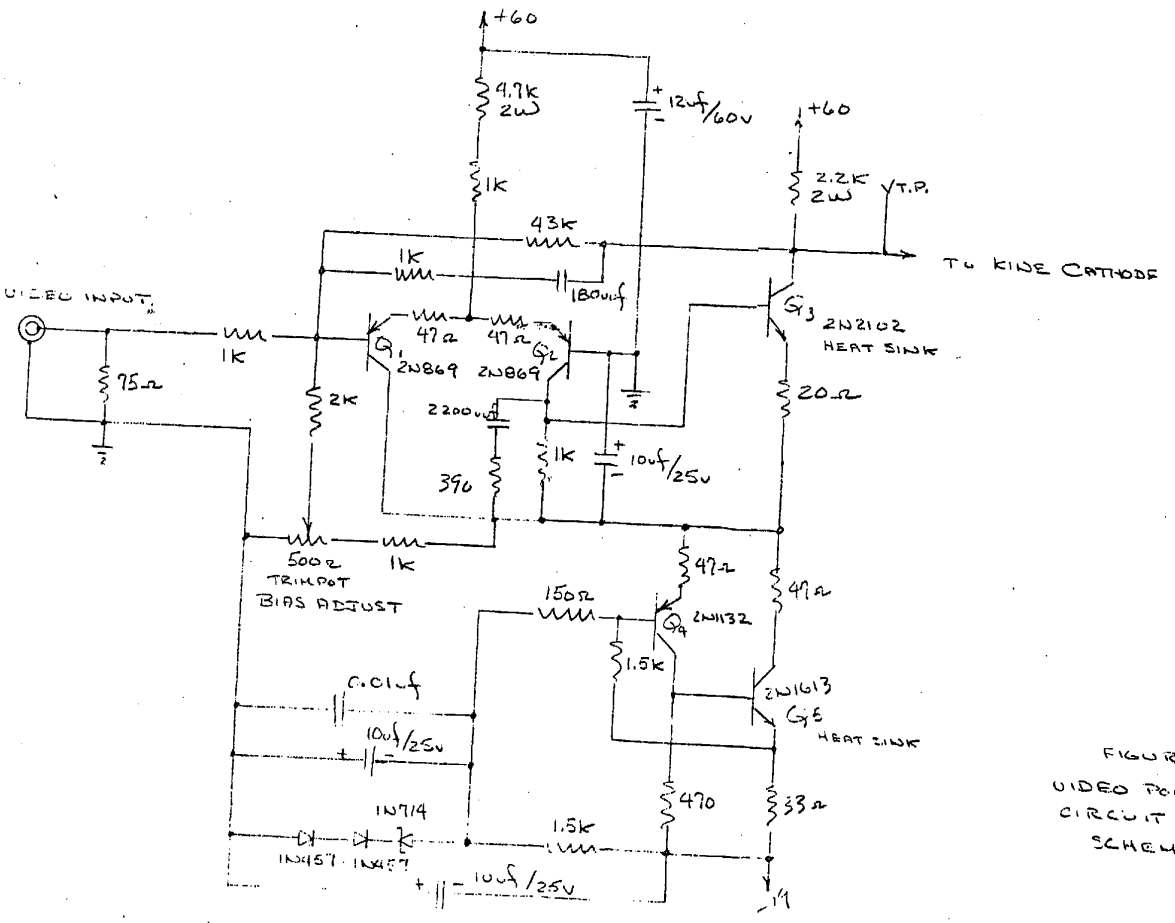


FIGURE A-5
VIDEO POWER AMPLIFIER
CIRCUIT BOARD PR-6019
SCHEMATIC DIAGRAM

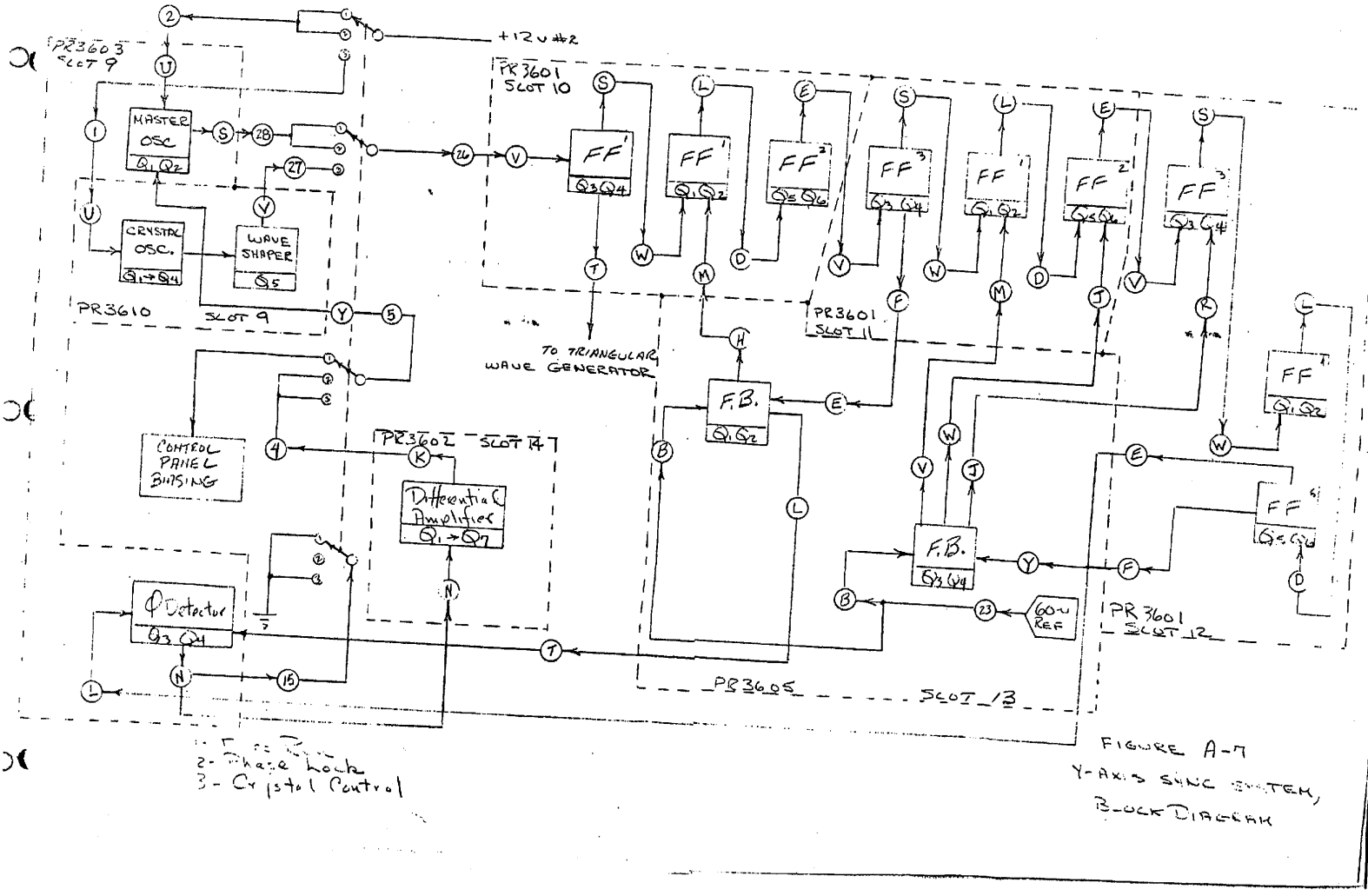


FIGURE A-7
Y-AXIS SYNC SWITCH, BLOCK DIAGRAM

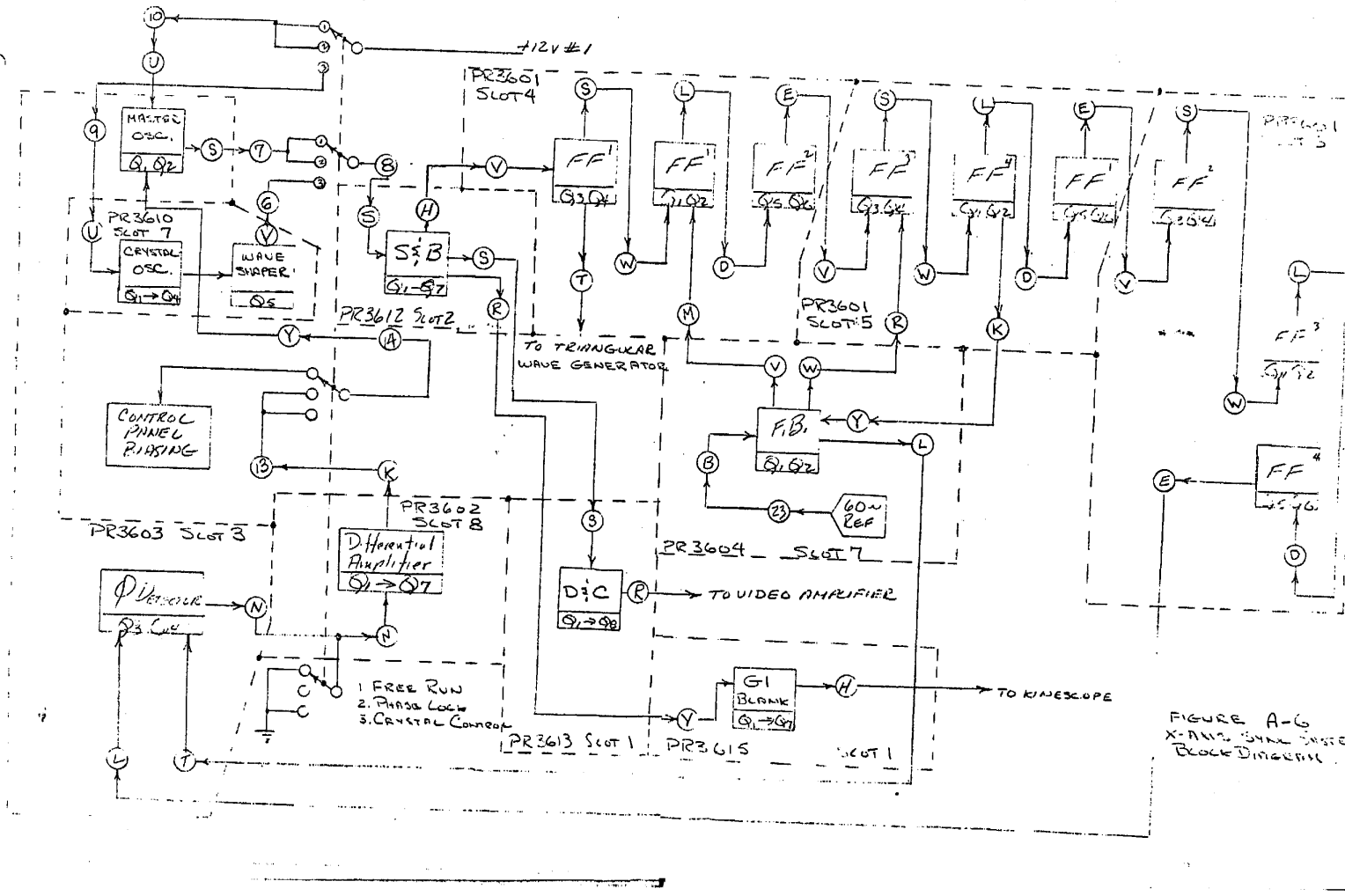


FIGURE A-6
X-RAY SYNC SYSTEM
BLOCK DIAGRAM

(2) An X-axis (horizontal) driving pulse at a frequency of 10.56 kilohertz.

(3) An X-axis blanking signal at twice the X-axis frequency to bias the kinescope off at the raster edges.

(4) A video clamping pulse to re-establish the d-c potential of the kinescope cathode during blanking time.

The entire solid-state synchronizing system is housed in the right-hand cabinet and consists of fourteen plug-in type cards. These cards, comprising ninety-eight transistorized stages, are located in the upper card nest.

Three distinct methods may be used to synchronize the electronics of the modulated-light film viewer. These operating modes are:

(1) The master oscillators may be crystal controlled.

(2) Voltage controlled oscillators may be phase locked to the 60-cps power line.

(3) The voltage controlled oscillators may be allowed to free-run.

Normally, the console electronics are synchronized to crystals by placing theoperating mode switch in the "CRYSTAL" position.

The phase lock mode and the free-run mode of operation can be used for operation, but these synchronization methods are primarily used for checking sweep linearity and adjusting the pulse and timing sequence.

In all modes of operation, the basic oscillator frequency is twice the sweep frequency and the first digital counter in the chain divides by two to provide the proper sweep frequency for each axis and insure symmetry to triangular wave generators. In the phase-lock mode of operation these sweep frequencies are divided to obtain 60 hertz. This signal is compared in each sync system with the 60-hertz line-frequency reference signal in the phase detector and an error signal is produced. This error signal is amplified in the differential amplifier and converted to a d-c voltage which is proportional to the phase difference between the generated 60-hertz signal and the line frequency. This voltage is used to lock the voltage-controlled oscillator to the proper frequency.

The isotropic box scan results from the interaction of the X-axis and the Y-axis triangular scans which have slightly different scanning frequencies. The resultant trace shown in Figure A-7A illuminates each point on the face of the kinescope within the raster rectangle from each of four directions once every 16.6 milliseconds.

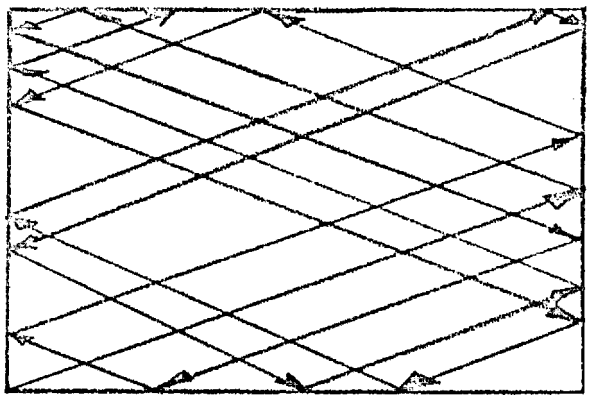


FIGURE A-7A PORTION OF ISOTROPIC-BOX-SCAN RASTER SHOWING DIRECTION OF CONTINUOUS TRACE ACROSS KINESCOPE FACE

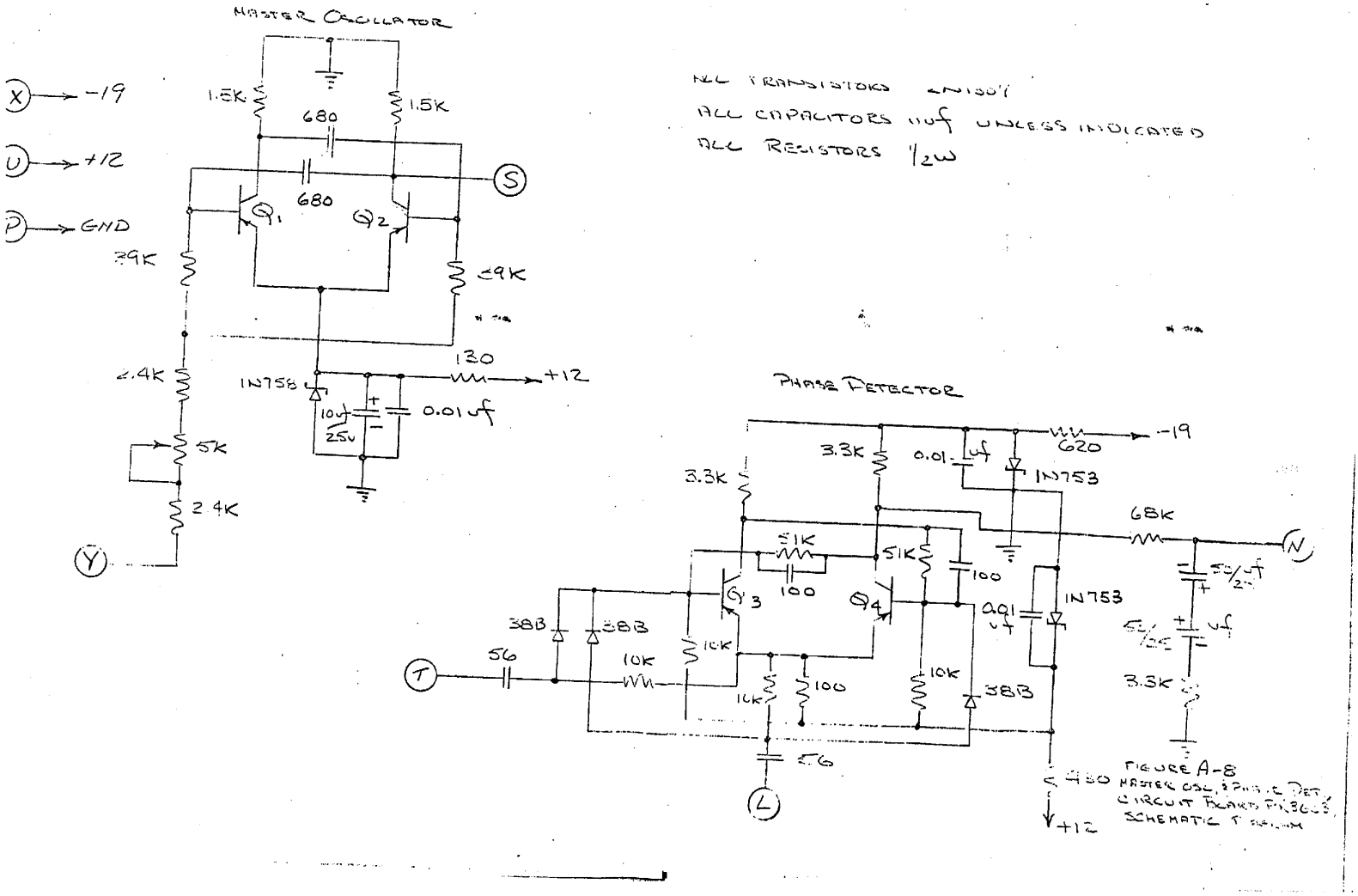
A.2.1 Master Oscillator and Phase Detector

The master oscillator and phase detector circuit board, shown in Figure A-8, is used in both the X-and Y-axis synchronous systems.

The master oscillator, used in both the free-run and phase-lock modes of operation is a voltage-controlled oscillator (VCO) which has an output frequency directly proportional to the d-c bias voltage applied to the bases of transistors Q_1 and Q_2. In the free-run mode of operation this bias voltage is obtained from a potentiometer on the auxiliary control panel. In the phase-lock mode of operation this bias voltage is the d-c error signal from the differential amplifier. The output frequency is 21.12 kilohertz for the X-axis oscillator and 21.00 kilohertz for the Y-axis oscillator. These frequencies are twice the respective deflection rates (10.56 kilohertz for X-axis and 10.50 kilohertz for Y-axis) and are integral multiples of 60 hertz.

The phase detector is a square-wave detector. The input is triggered by the last counter in the synchronous dividing chain and the reset is simultaneously driven by a square wave derived from the basic 60-hertz power-line frequency. The output is an integrated d-c voltage which is directly proportional to the phase difference between the triggering signal* and the 60-hertz power-line frequency.

* The signal that is developed by the sync systems.



A.2.2 Crystal-Controlled Oscillator and Wave Shaper

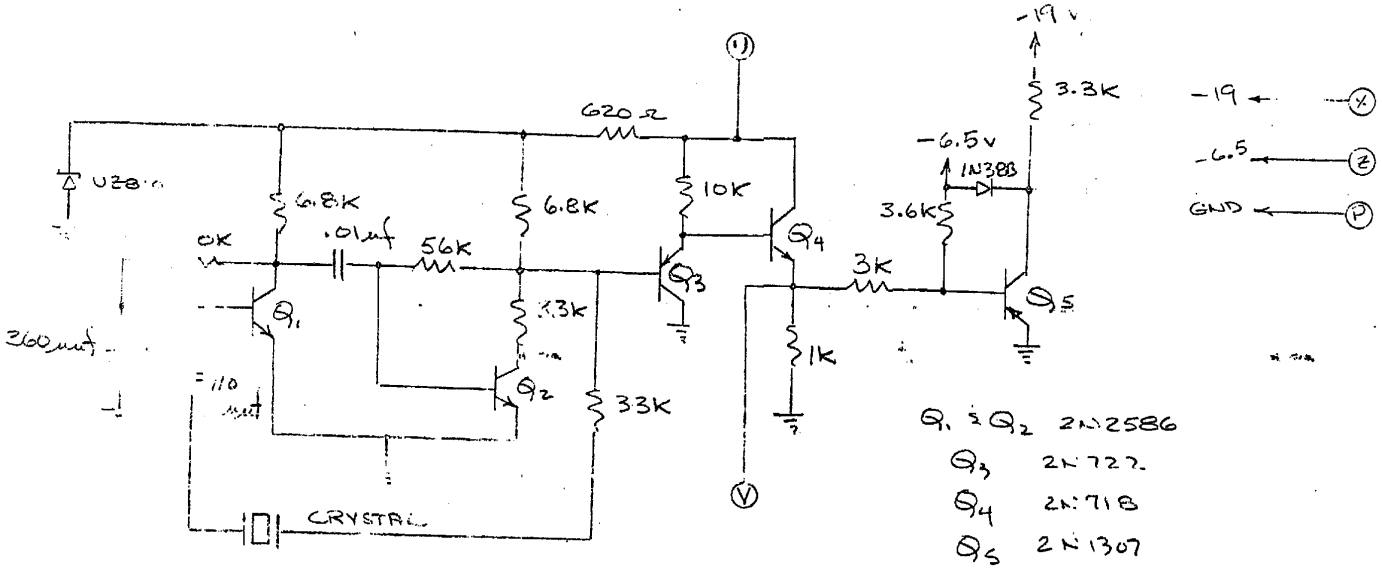
One of these crystal-controlled oscillator and wave shaper circuit boards, shown in Figure A-9, is used in both the X- and the Y-axis synchronous systems when in the crystal-control mode of operation.

The oscillators in the X-and Y-axis systems operate at frequencies of 21.12 and 21.00 kilohertz, respectively, twice the respective sweep frequencies. An emitter follower buffer amplifier circuit on each board isolates the oscillator from a wave-shaper circuit which forms the square wave. The output of the wave shaper is applied to the shift and blanking generator in the X-axis system and to the first digital counter in the Y-axis system.

B.2.3 Shift and Blanking Generator

The shift and blanking generator circuit board, shown in Figure A-10, is used in the X-axis synchronous system. The pulse-shift circuit provides a 3-microsecond delay to the clock pulse from the oscillator to the first digital counter.

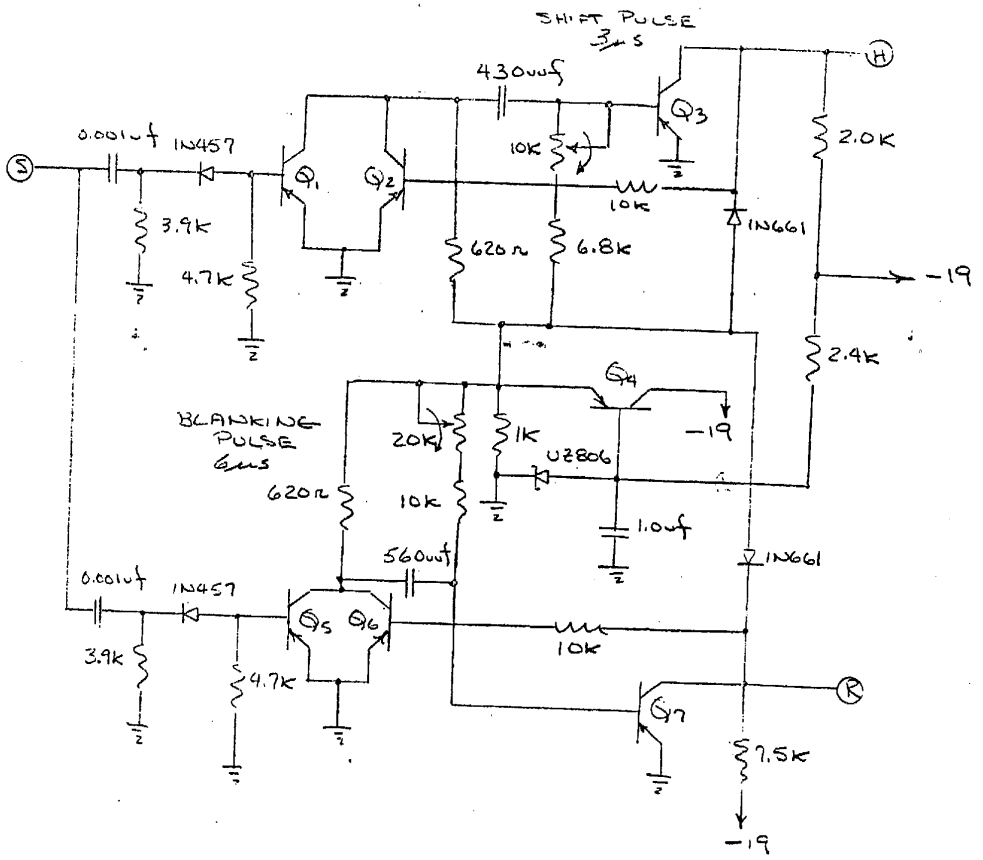
The blanking pulse circuit provides a 6-microsecond pulse which starts once each half cycle of the basic unshifted oscillator pulse. This pulse is supplied to the control

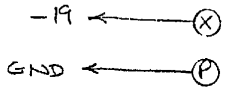


Q_1 & Q_2 2N2586
Q_3 2N727
Q_4 2N718
Q_5 2N1307

CRYSTAL FOR X-AXIS SYNC 21.12KC
CRYSTAL FOR Y-AXIS SYNC 21.00KC
ALL RESISTORS ½W

FIGURE A-9
CRYSTAL-CONTROLLED OSC. CIRCUIT BOARD PB3610, SCHEMATIC DIAGRAM





ALL RESISTORS 1/2W

Q1, Q2, Q3, Q5, Q6, Q7 2N2613

Q4 2N1307

FIGURE A-10, SHIFT & BLANKING GENERATOR, CIRCUIT BOARD PR3612, SCHEMATIC DIAGRAM

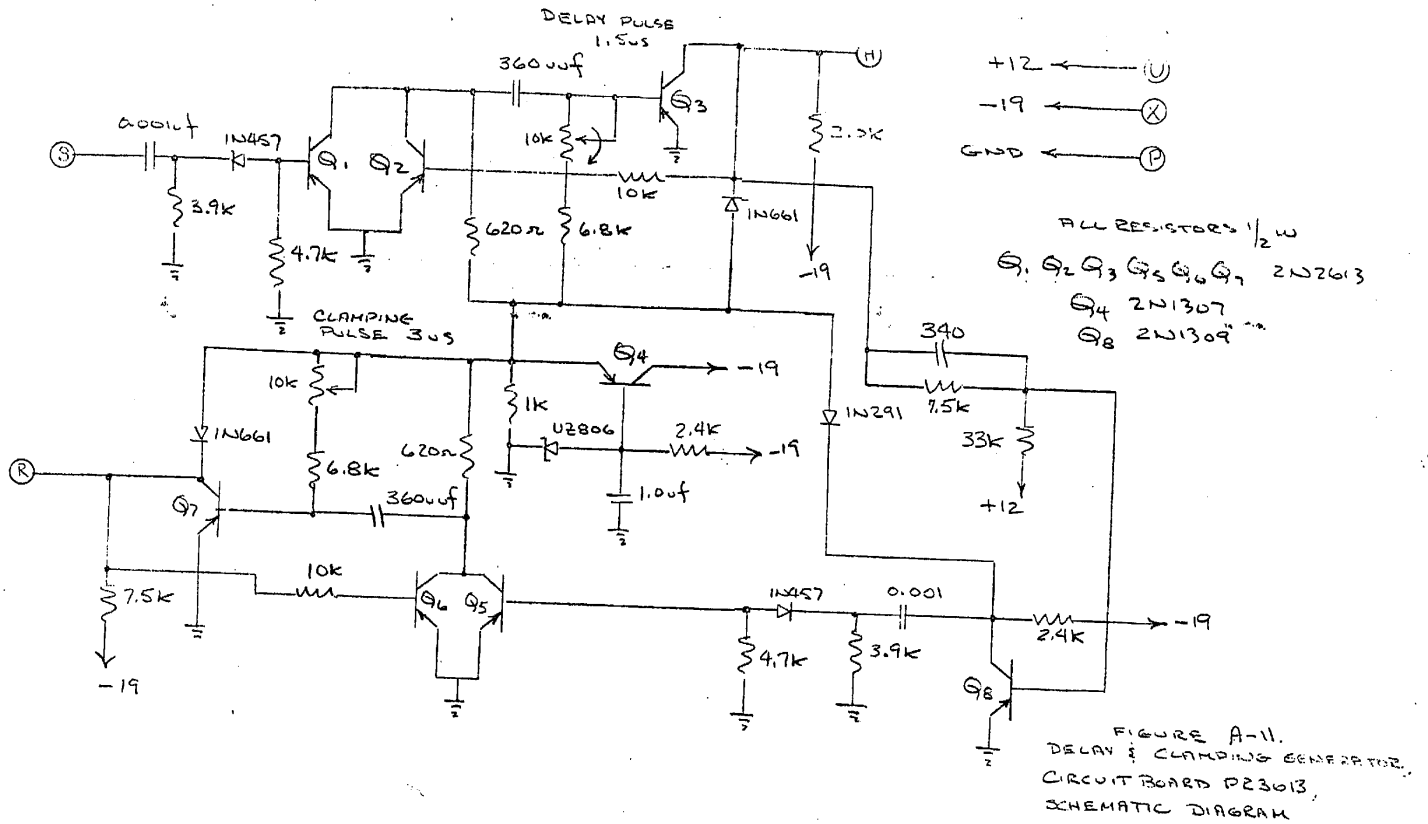
grid of the kinescope through the G1 blanking amplifier. This blanking pulse is symetrical about both the negative and positive peaks of the triangular deflection signal to remove the kinescope trace at the raster edges.

A.2.4 Delay and Clamping Generator

The delay and clamping generator circuit board, shown in Figure A-11, is used in the X-axis synchronous system. The delay-pulse circuit provides a 1.5-microsecond pulse which is triggered once each half-cycle of the basic oscillator pulse. The trailing edge of the 1.5-microsecond pulse triggers the clamping-pulse circuit whichprovides a 3-microsecond clamping pulse. This pulse, which is supplied to the video processer, is symetrical about the center of the blanking pulse with time shifts of 1.5-microseconds between the respective leading and trailing edges.

A.2.5 G1 Blanking Amplifier

The G1 blanking amplifier circuit board, shown in Figure A-12, is used in the X-axis synchronous system. This circuit amplifies the blanking pulse from the delay and blanking generator and supplies this pulse to the control grid, G1, of the kinescope to remove the trace from the kinescope when video clamping occurs.



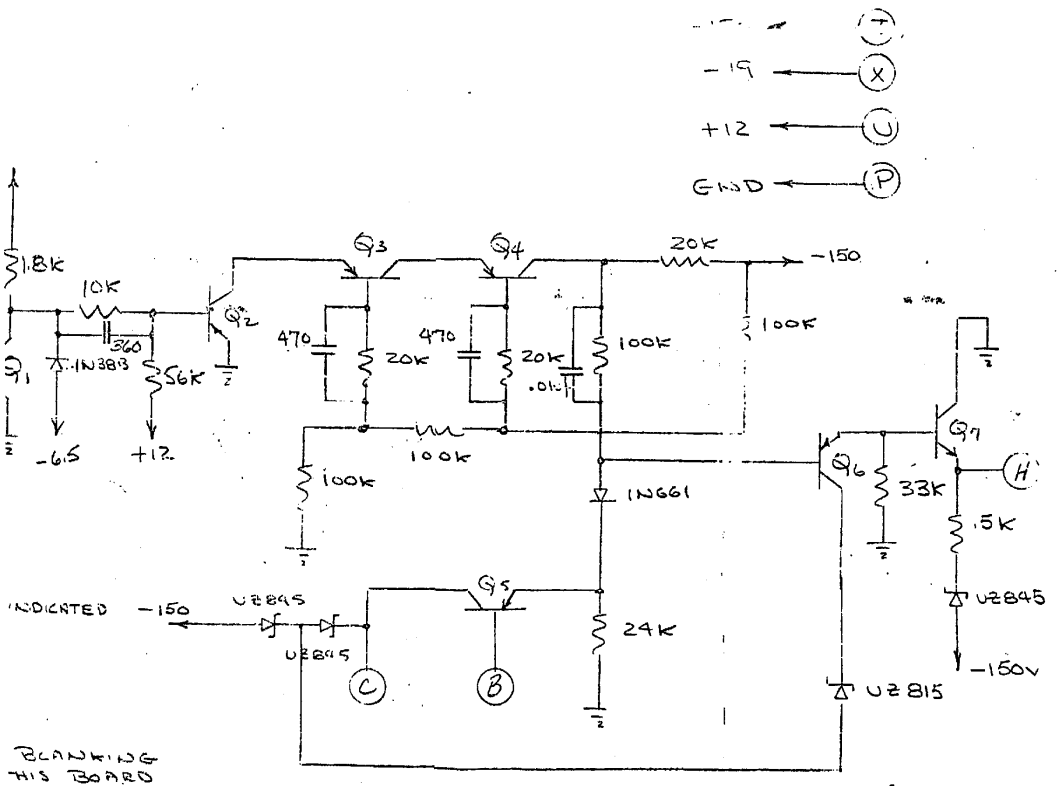


FIGURE A-12
G1 BLANKING AMPLIFIER
CIRCUIT BOARD PR3615,
SCHEMATIC DIAGRAM

A.2.6 Digital Counters

The digital counter circuit board, shown in Figure A-13, is composed of three identical digital counters (bi-stable multivibrators). Each counter is composed of two single-input computer gates. These counters are used to divide the oscillator frequency in both the X- and Y-axis synchronous systems.

A.2.7 Digital Feedback Control and Schmitt Triggers

The digital feedback control and Schmitt trigger circuit boards, shown in Figures A-14 and A-15, are used in the X-and Y-axis synchronous systems, respectively. Each board contains two Schmitt trigger circuits and digital feedback control circuits. The Schmitt triggers shape the 60-Hertz line-frequency sinisoidal signal to a square wave to provide the reference signal to the phase detectors.

The digital feedback control circuits provide isolation for the feedback paths in the counter chains. Also, voltage regulators provide clamp voltages to the digital counters.

A.2.9 Differential Amplifier and Parallel - T Rejection Network

The differential amplifier and parallel-T rejection network circuit board, shown in Figure A-16, is used in both the X-and Y-axis synchronous systems. In the phase-lock

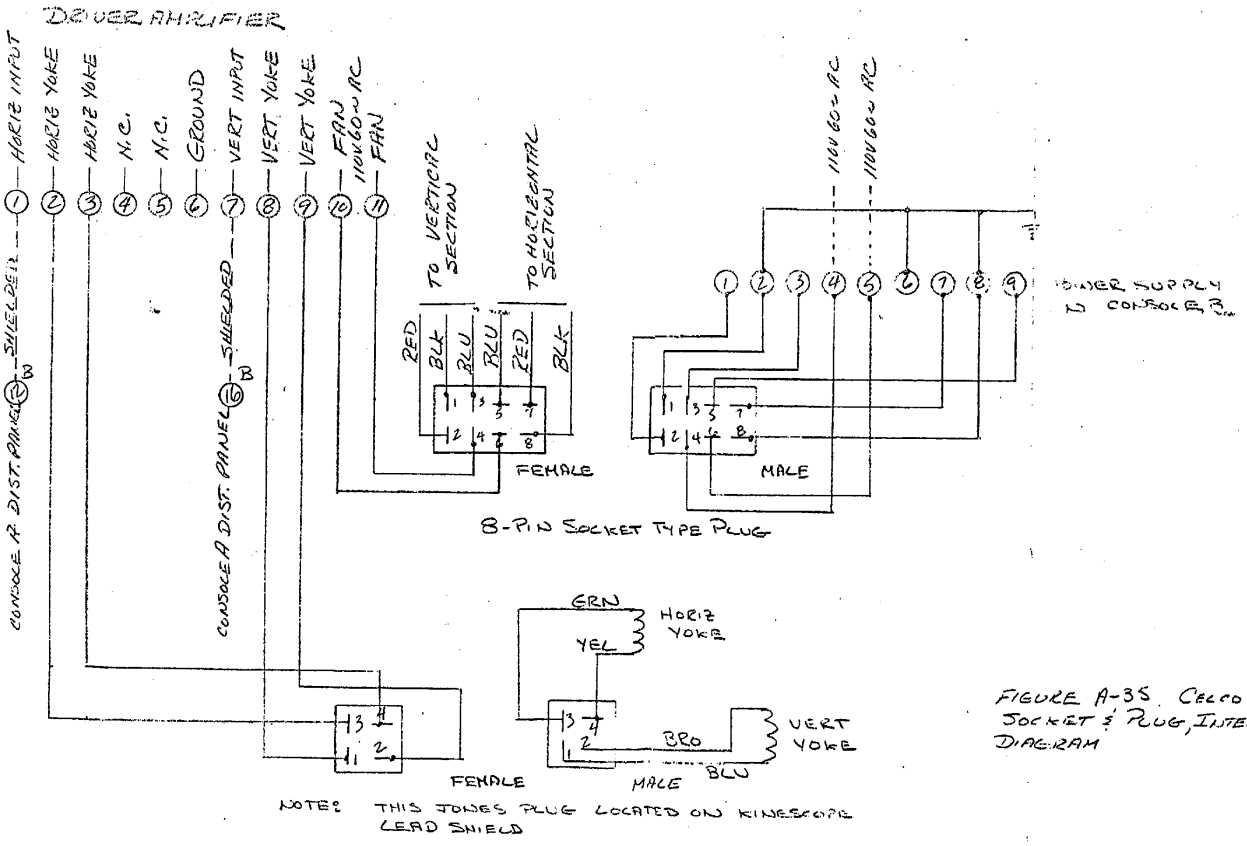


FIGURE A-35. CELCO DRIVER SOCKET & PLUG, INTERCONNECTION DIAGRAM

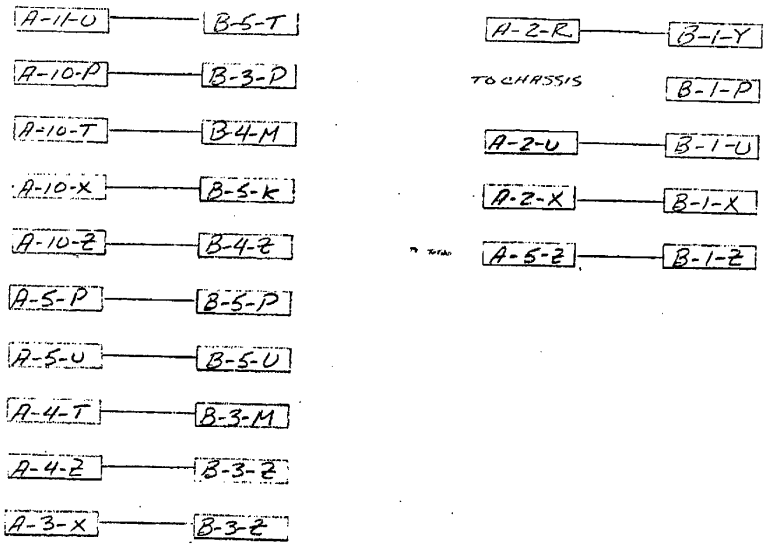


FIGURE A-34
ANELT TO BNELT
INTERCONNECTION DIAGRAM

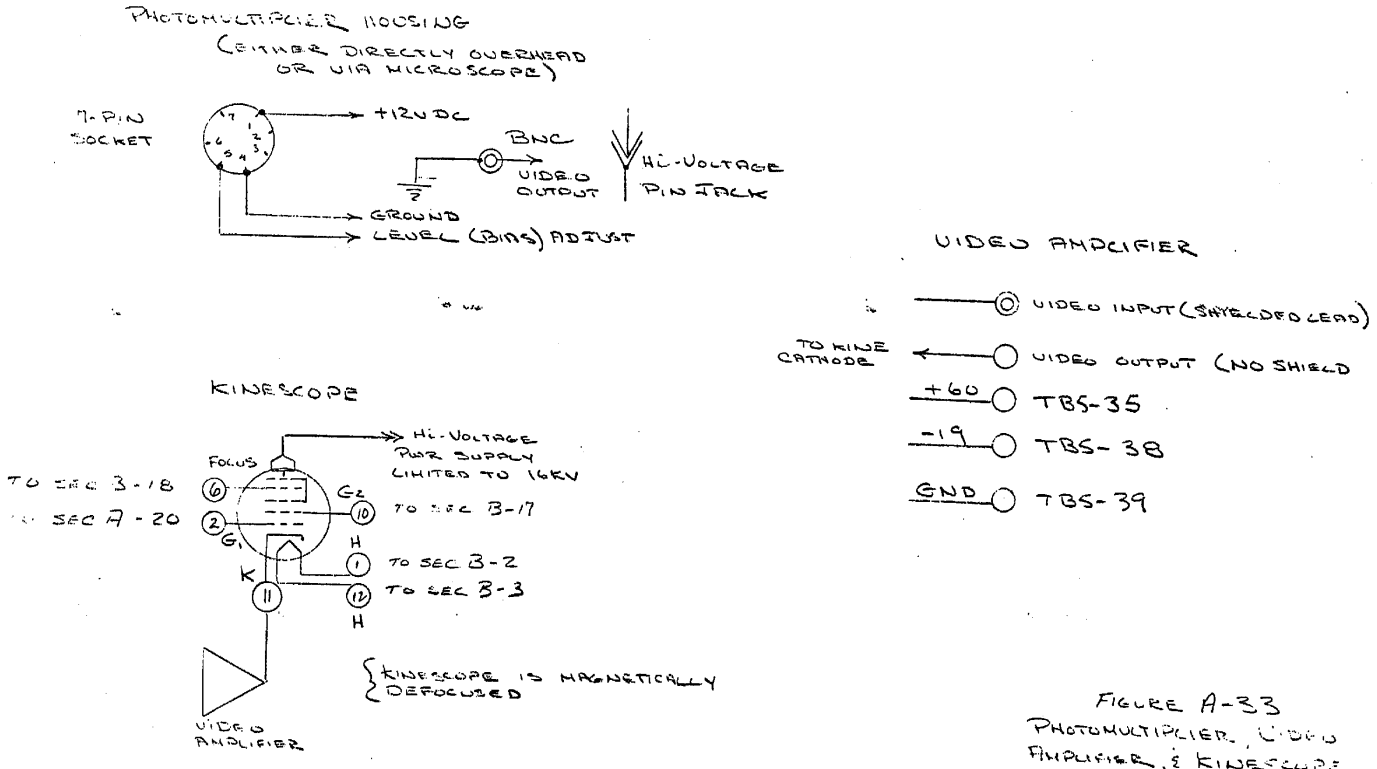


FIGURE A-33
PHOTOMULTIPLIER, VIDEO AMPLIFIER, & KINESCOPE WIRING DIAGRAM

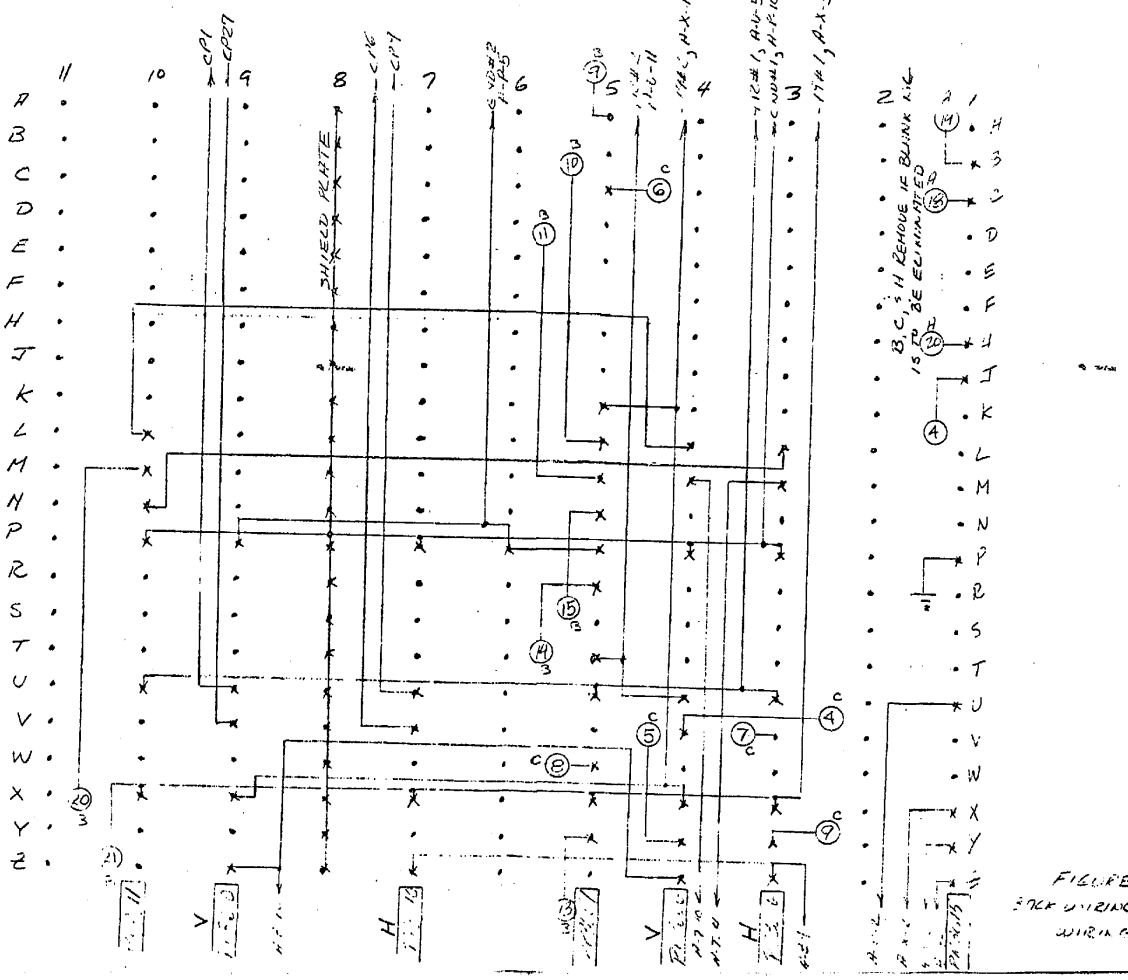


FIGURE A-32
SKE WIRING CARD NO. 3, WIRING DIAGRAM

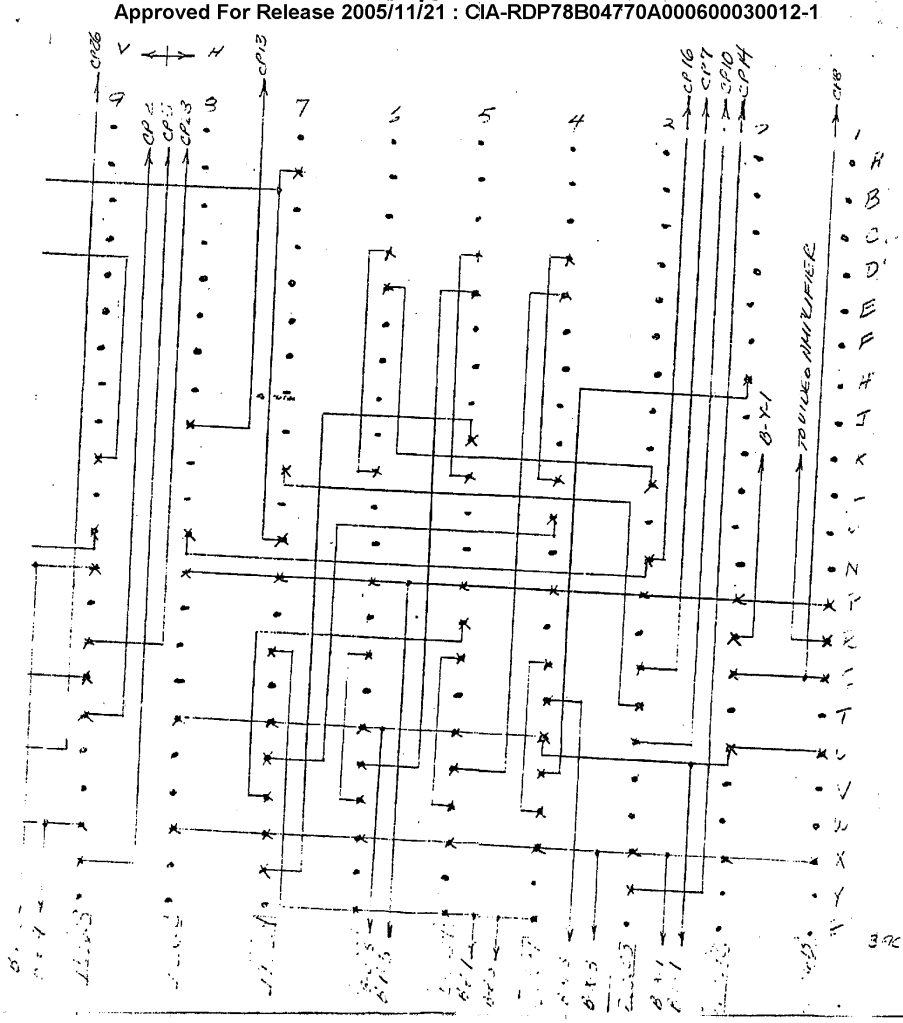
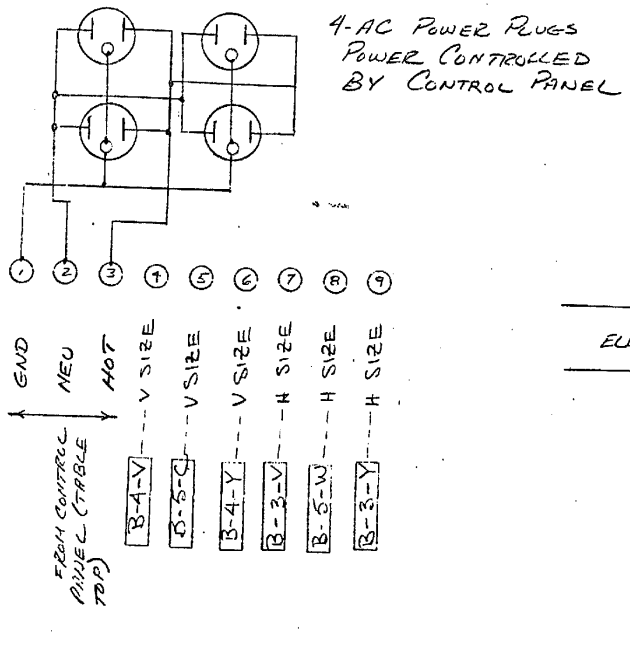


FIGURE A-31
BACKPLANE WIRE LIST A3
WIRING DIAGRAM



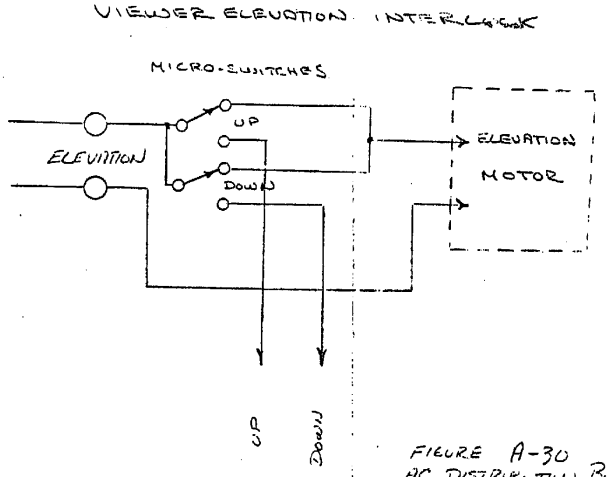


FIGURE A-30
AC DISTRIBUTION BOX AND SECTION C, WIRING DIAGRAM

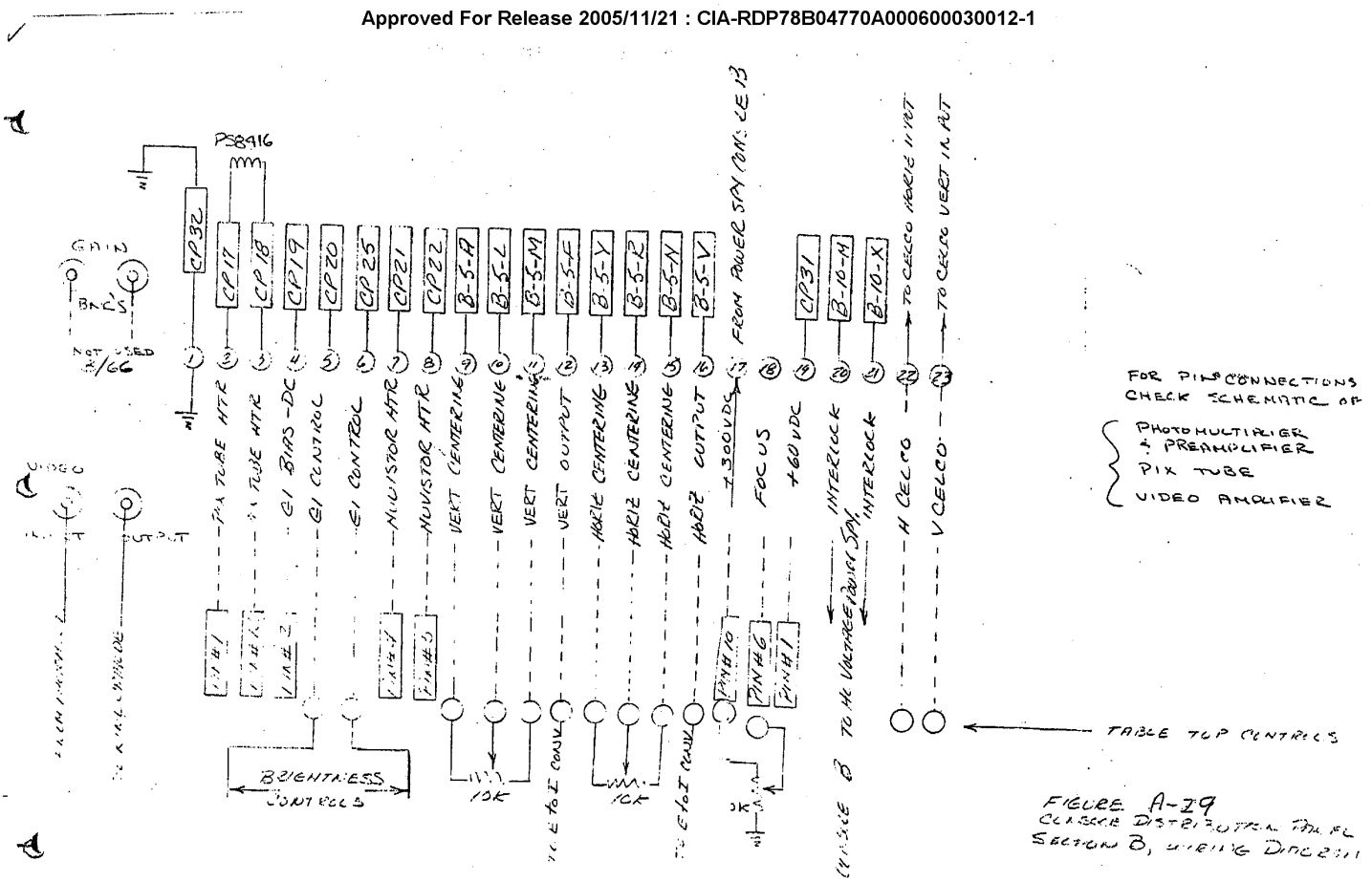


FIGURE A-19
CLOSED CIRCUIT TV
SECTION B, WIRING DIAGRAM

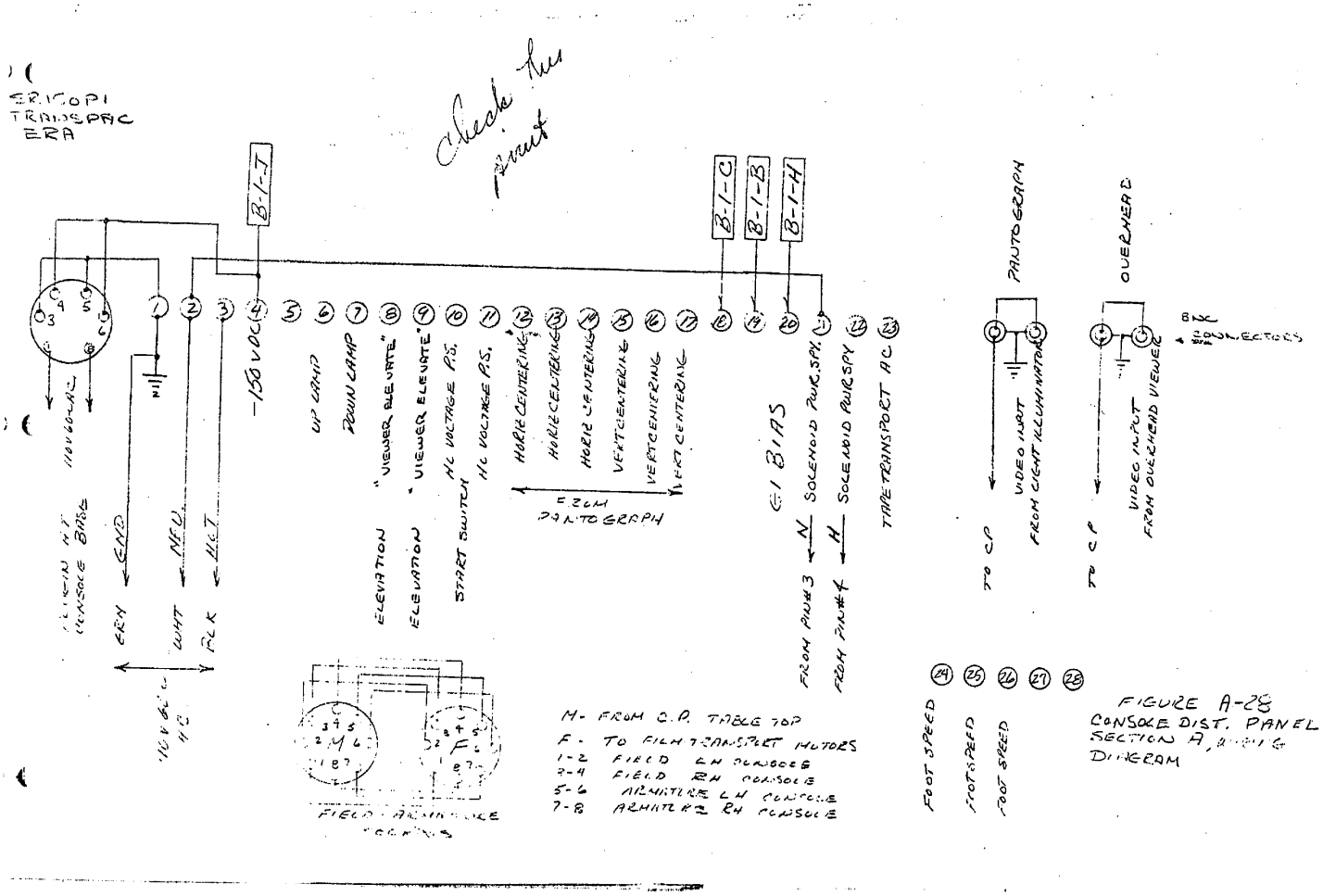


FIGURE A-28
CONSOLE DIST. PANEL
SECTION A, WIRING
DIAGRAM

A.10 ELECTRICAL INTERFACE

The wiring and interconnection diagrams for the modulated-light film-viewing table are shown in Figures A-28 through A-35.

A.11 WIRING LISTS

Following Figure A-35 is a complete wiring diagram, cable designation, and additional schematics for the modulated light film viewer.

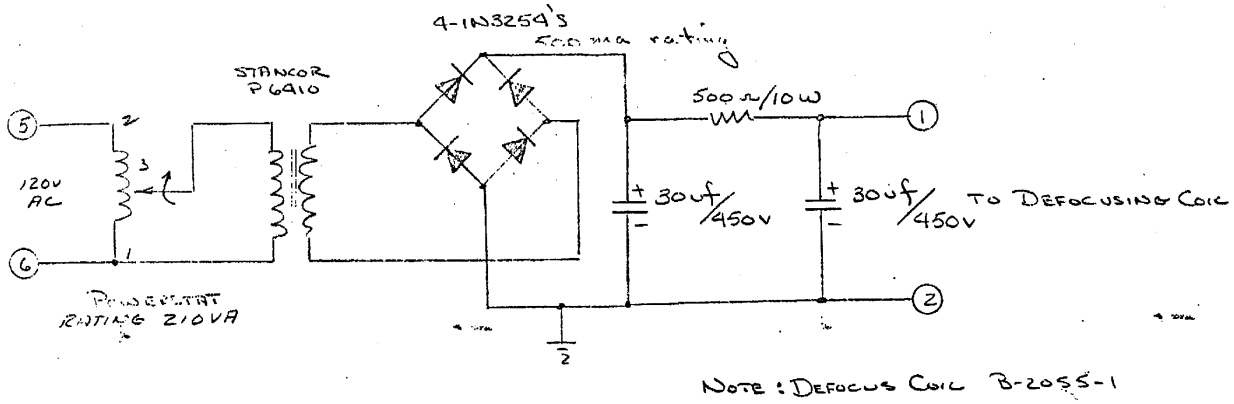


FIGURE A-27
MAGNETIC DEFOCUSING REGULATOR, SCHEMATIC DIAGRAM

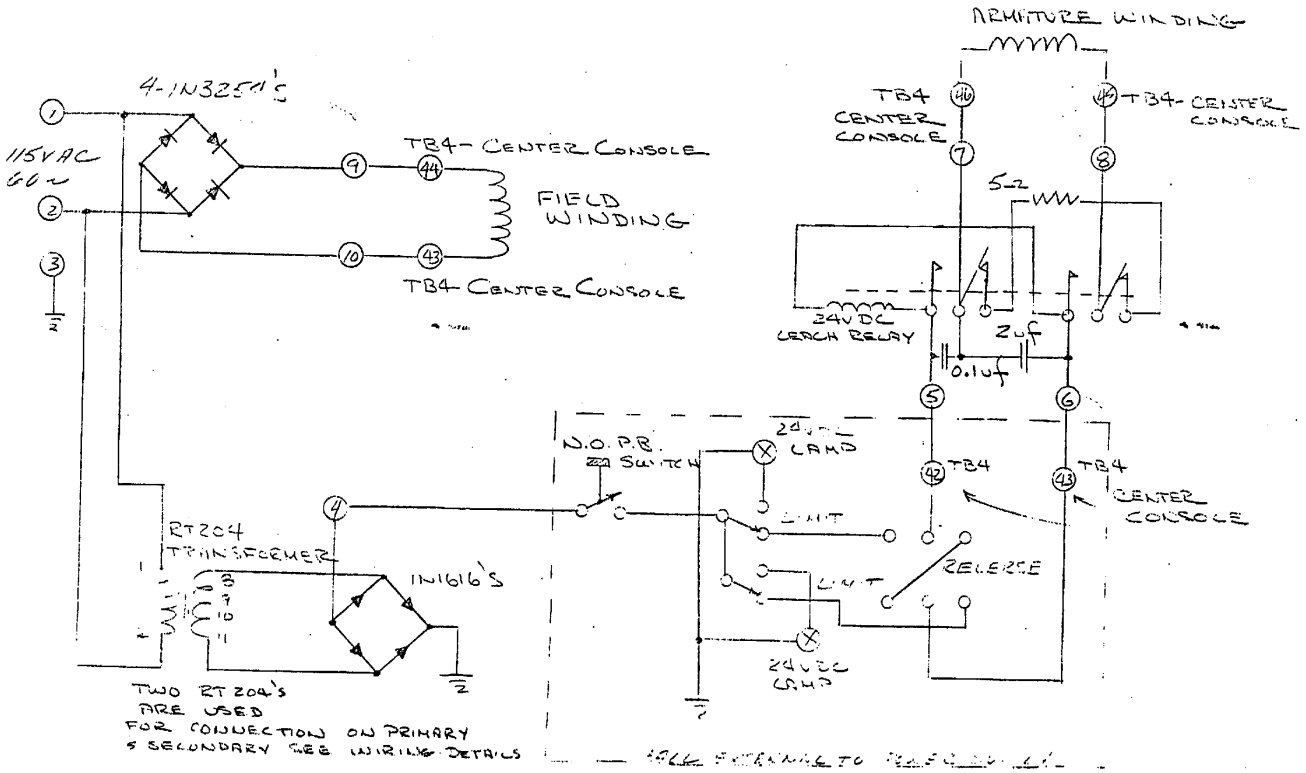


FIGURE A-26
TILT CONTROL SYSTEM
SCHEMATIC DIAGRAM

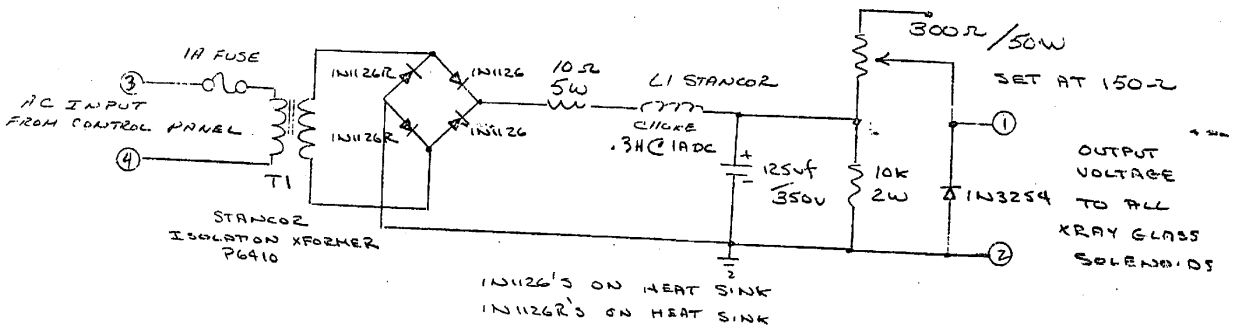


FIGURE A-25

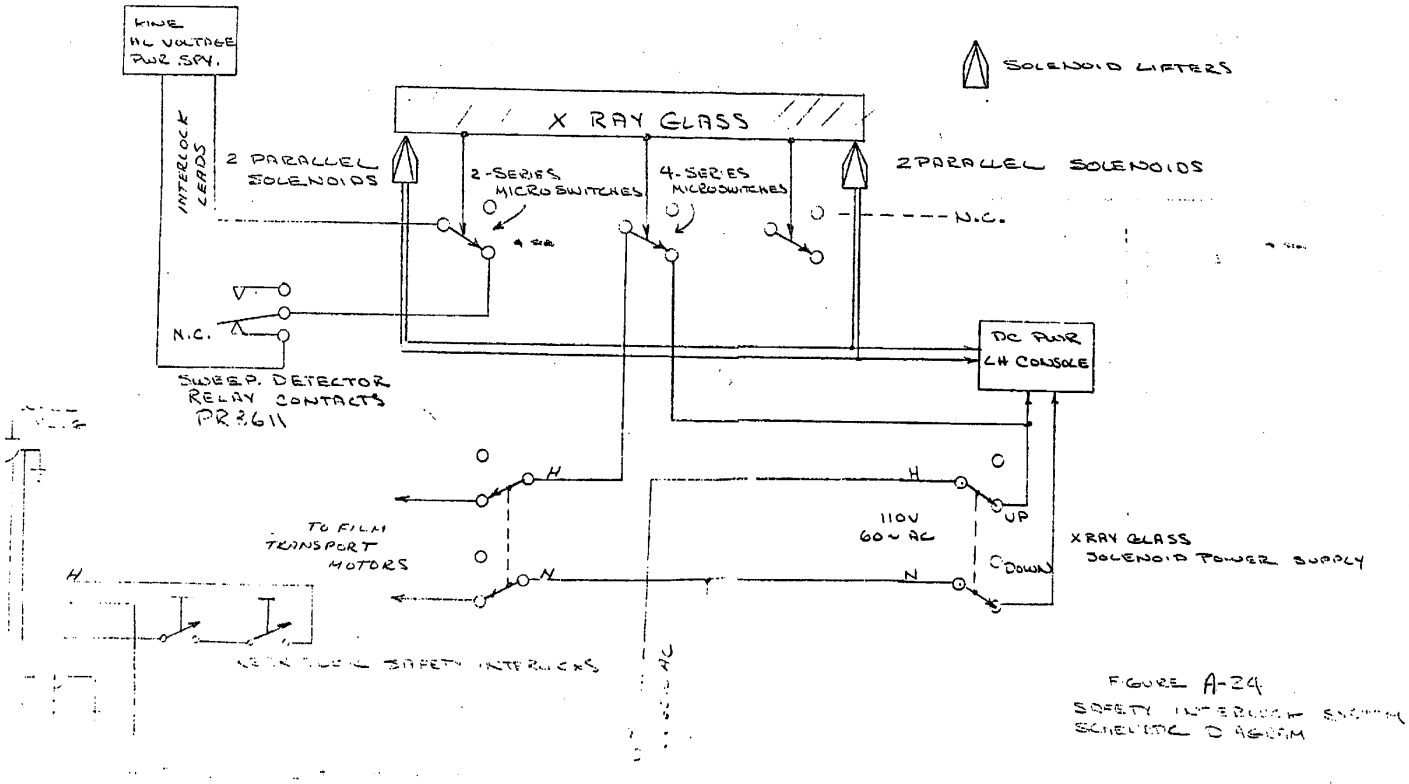


FIGURE A-24
SAFETY INTERLOCK SYSTEM
SCHEMATIC DIAGRAM

A.7 SAFETY INTERLOCK SYSTEM

The safety interlock system, shown in Figure A-24, interrupts the main source of power to the table when rear doors are opened, and provides solenoid lifters to lift the X-ray safety glass over the kinescope face so that the film can be transported. Switches stop the film transport system and interrupt the hi-voltage to the kinescope when the glass in down. The power supply for the lifter solenoids is shown in Figure A-25.

A.8 TILT CONTROL SYSTEM

The tilt control system, shown in Figure A-26, provides control of the d-c elevation motor to enable the film-viewing table top to be set at a convenient angle. Power to the armature of the d-c motor is automatically interrupted and a LIMIT lamp lights when either limit of position is reached. At either limit, power can be applied only to reverse the direction of motion. The field winding of the motor is controlled by the POWER switch of the viewing table.

A.9 MAGNETIC DEFOCUSING REGULATOR

The magnetic defocusing regulator circuit, shown in Figure A-27, provides a controlled d-c current through the defocusing coil to enlarge the electron beam diameter and increase the illuminated spot diameter. This defocusing is necessary when the diffuser is removed from in front of the kinescope face so that the individual raster lines are not visible.

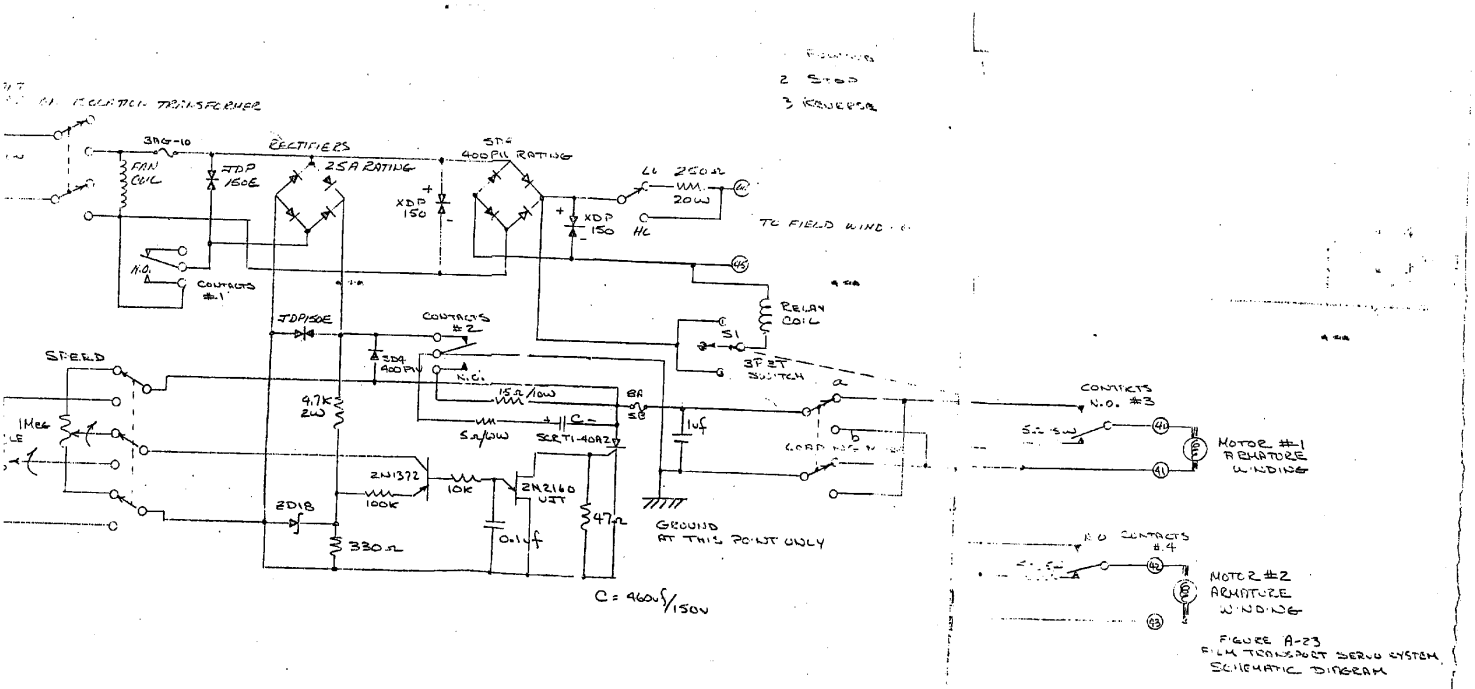


FIGURE A-23
FILM TRANSPORT SERVO SYSTEM
SCHEMATIC DIAGRAM

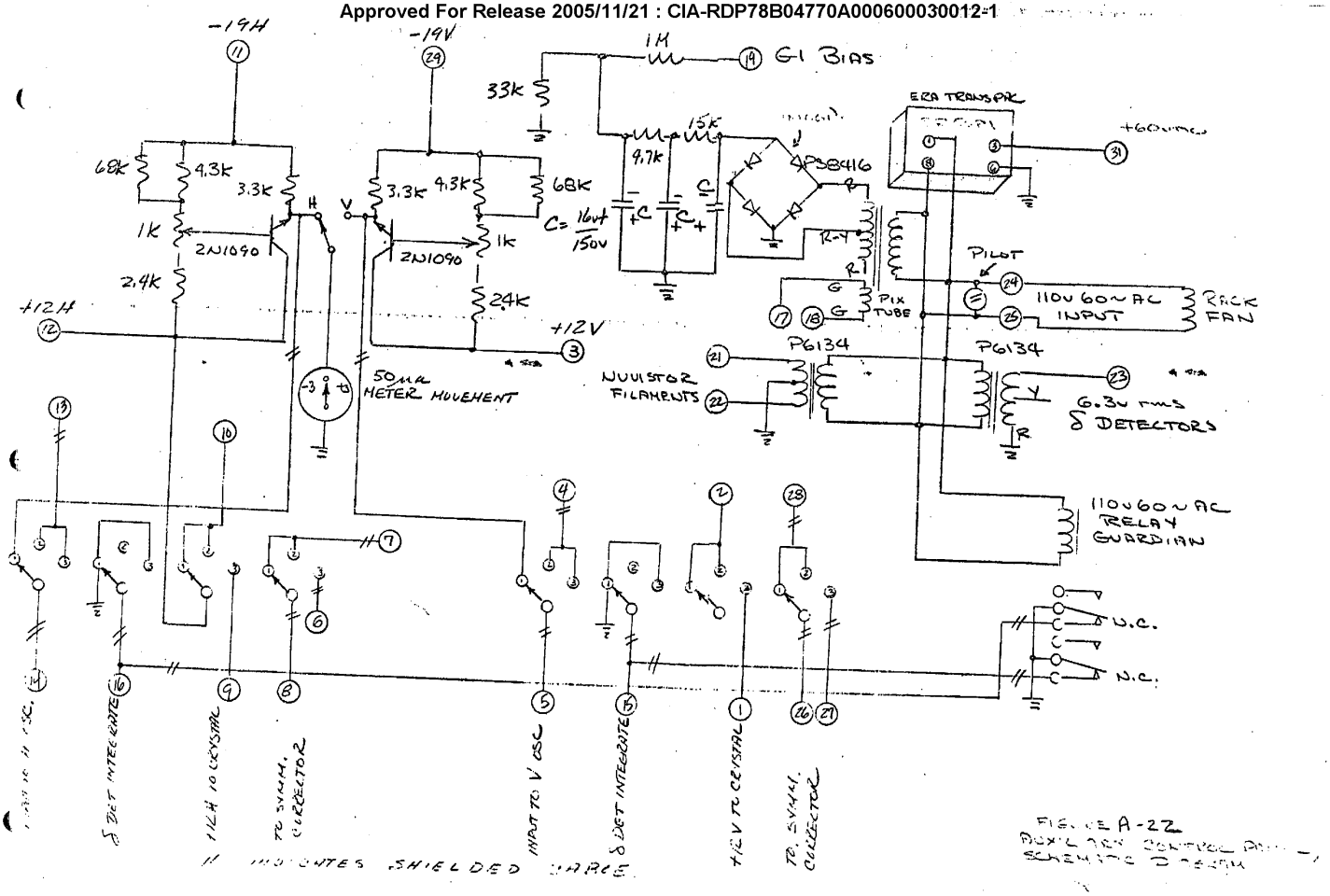
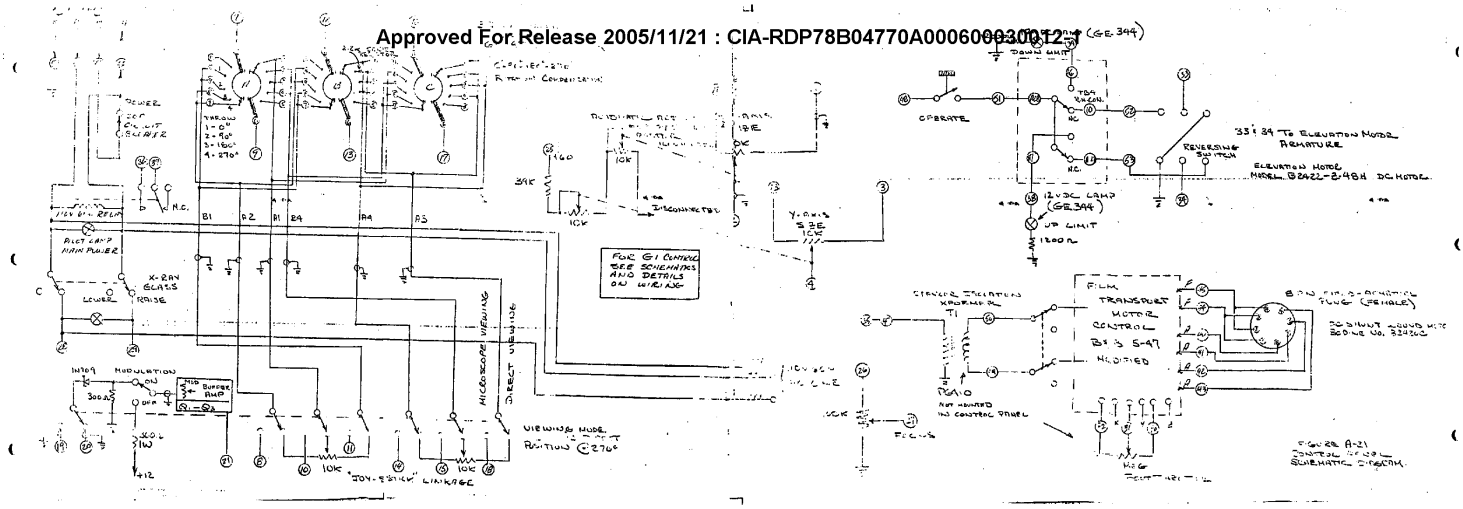


FIGURE A-22



A.4 CONTROL PANEL

The main control panel, shown in Figure A-21, provides controls for all the functions of the modulated-light film-viewing table.

A.5 AUXILIARY CONTROL PANEL

The auxiliary control panel provides power for the phase detectors and G1 bias, filament power for the Nuvistors in the photomultiplier preamplifier, switches to select the mode of operation of the synchronous systems, and a meter and controls to set the frequency of the master oscillator for the free-running mode of operation. A schematic diagram of the panel is shown in Figure A-22.

A.6 FILM TRANSPORT SERVO SYSTEM

The film transport servo system, shown in Figure A-23, provides speed and direction control for the film transport system.

Transistors Q_1 and Q_2 provide biasing and gate current to the silicon-controlled rectifier, Q_3, which, in turn, regulates the current to the armature of the energized motor.

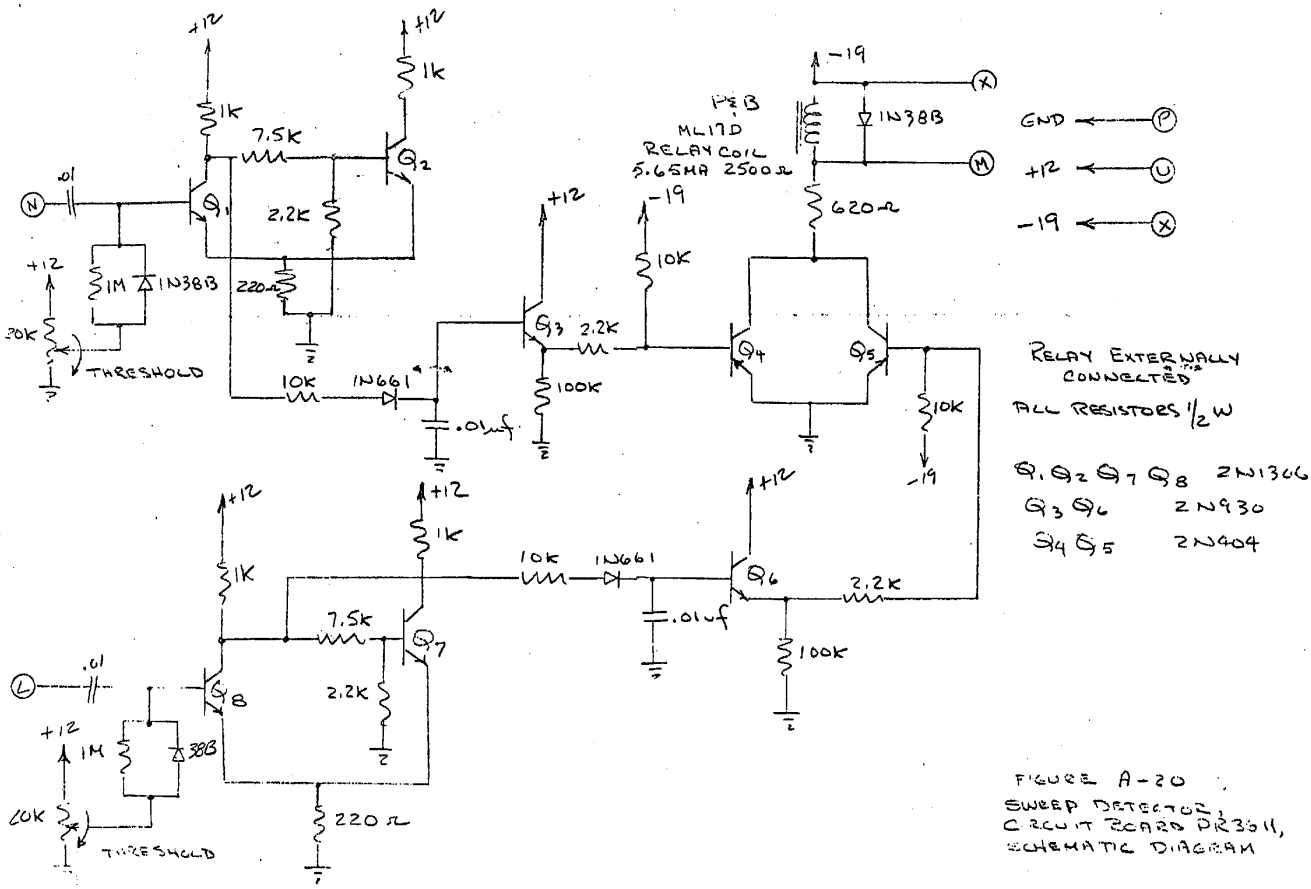


FIGURE A-20
SWEEP DETECTOR, CIRCUIT BOARD DR3611, SCHEMATIC DIAGRAM

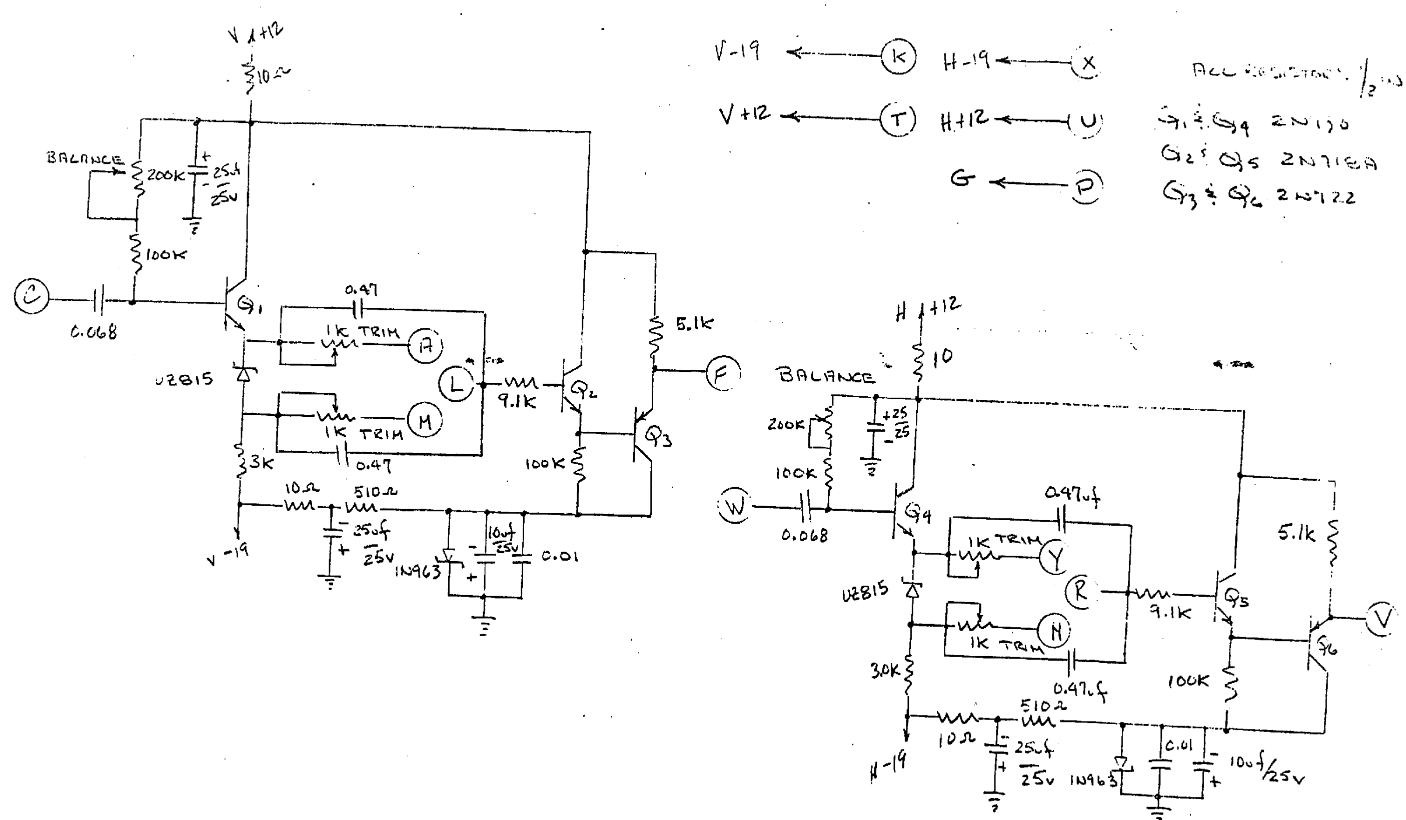


FIGURE A-19
ISOLATION AMPLIFIERS
... BOARD DP3607
SCHEMATIC DIAGRAM

This voltage signal passes through an emitter follower circuit and is fed to an isolation amplifier.

A.3.2 Isolation Amplifiers

The isolation amplifiers circuit board, shown in Figure A-19, has an amplifier circuit for both the X-and Y-axis deflection systems. These amplifiers provide isolation between the triangular wave shape generators and the yoke driver amplifier (E-to-I converter) which follows, and superimpose externally controlled d-c biases on the triangle signals to allow the raster to be positioned on the face of kinescope.

A.3.3 Sweep Detector

The sweep detector circuit board, shown in Figure A-20, is used in the yoke driver system. This circuit senses the presence or absence of signals at the output of both the X- and Y-axis triangle generators. In the event that no signal is present at the output of either or both of the triangle generators, a relay is energized, removing input power to the high voltage circuit to prevent damage to the phosphor surface of the kinescope.

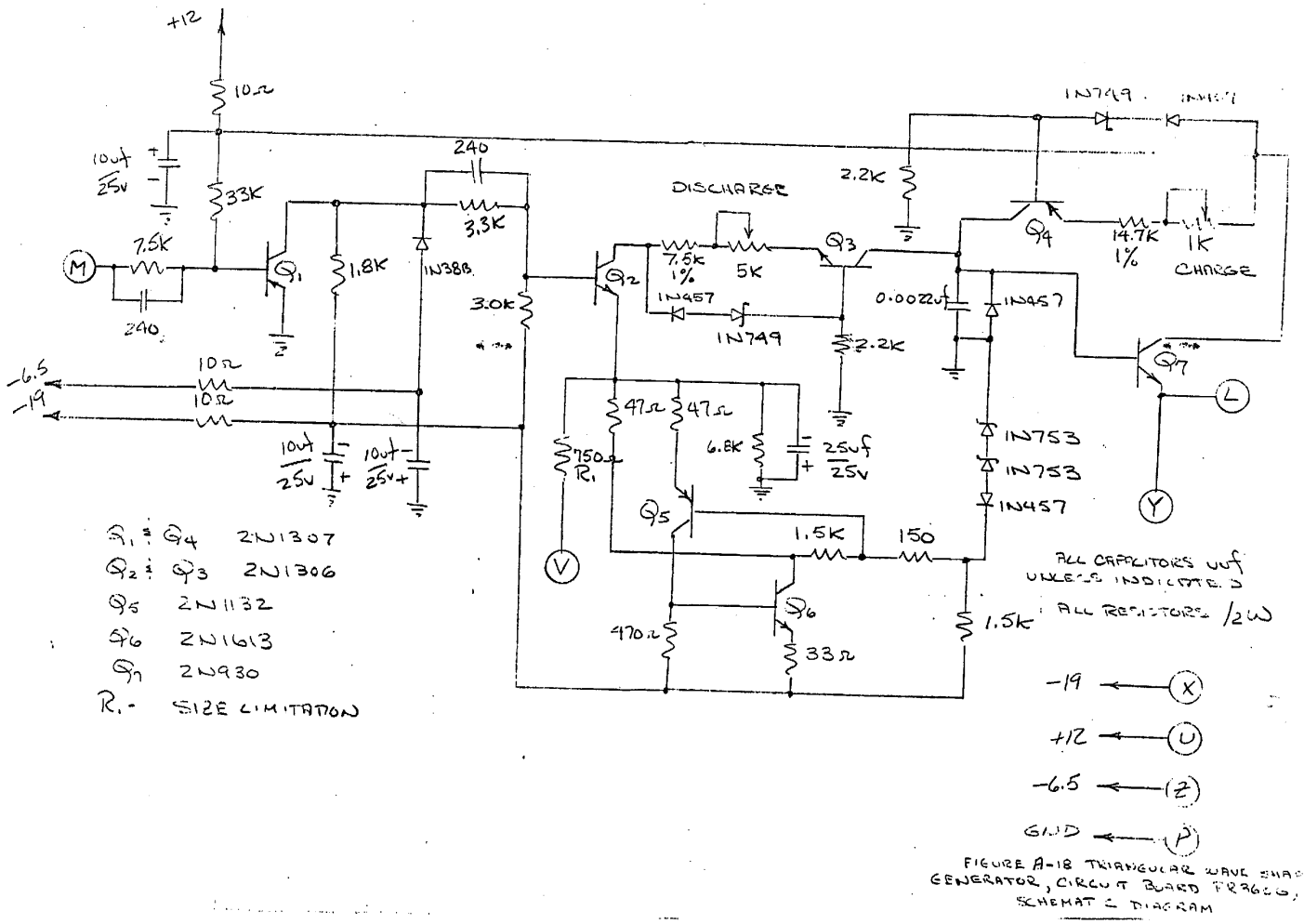


FIGURE A-18 TRIANGULAR WAVE SHAPE GENERATOR, CIRCUIT BOARD TR3610, SCHEMATIC DIAGRAM

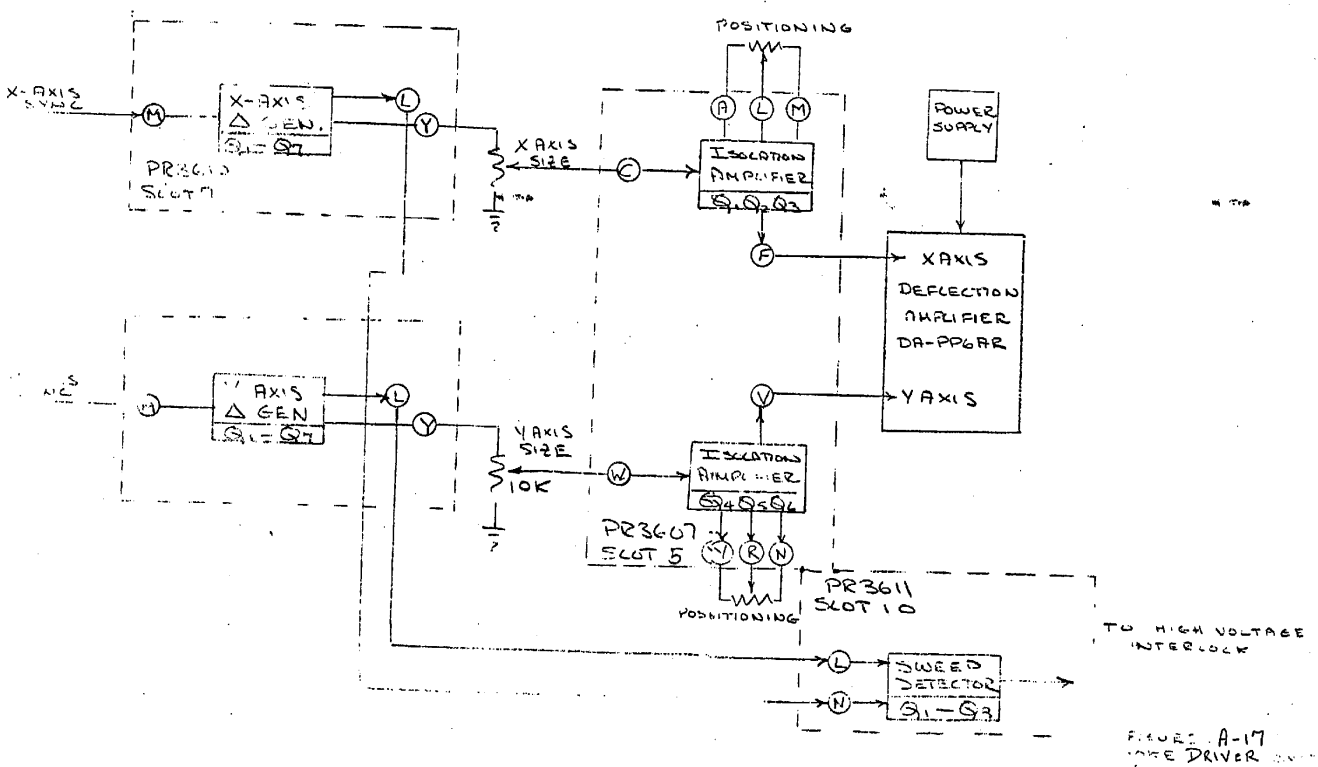


FIGURE A-17
[illegible] DRIVER [illegible]

synchronous mode of operation, the d-c error signal from the phase detector is amplified and inverted in the differential amplifier. The parallel-T rejection network filters the 60-hertz line frequency modulation so that is is not present in the output scanning waveform.

A.3 X-AND Y-AXIS YOKE DRIVER SYSTEM

The X-and Y-axis yoke driver system, shown in Figure A-17, produces a signal with a triangular waveform of voltage for each axis at the deflection frequency for each axis, amplifies each signal, and converts them into current signals with the same waveform to drive the kinescope deflection yoke, and produce the isotropic raster. Controls are provided to vary the size of the raster and position of the raster on the face of the kinescope.

A.3.1 Triangular Wave Shape Generator

The triangular wave shape generator circuit board, shown in Figure A-18, is used in both the X-and the Y-axis deflection systems. The generator is composed of two constant-current generator circuits. One circuit charges a capacitor at a constant rate continuously. The other generator produces a negative current with twice the magnitude of the continuous current. This second current flows only during one-half of the cycle to discharge the capacitor. The result is a triangular-wave of voltage across the capacitor.

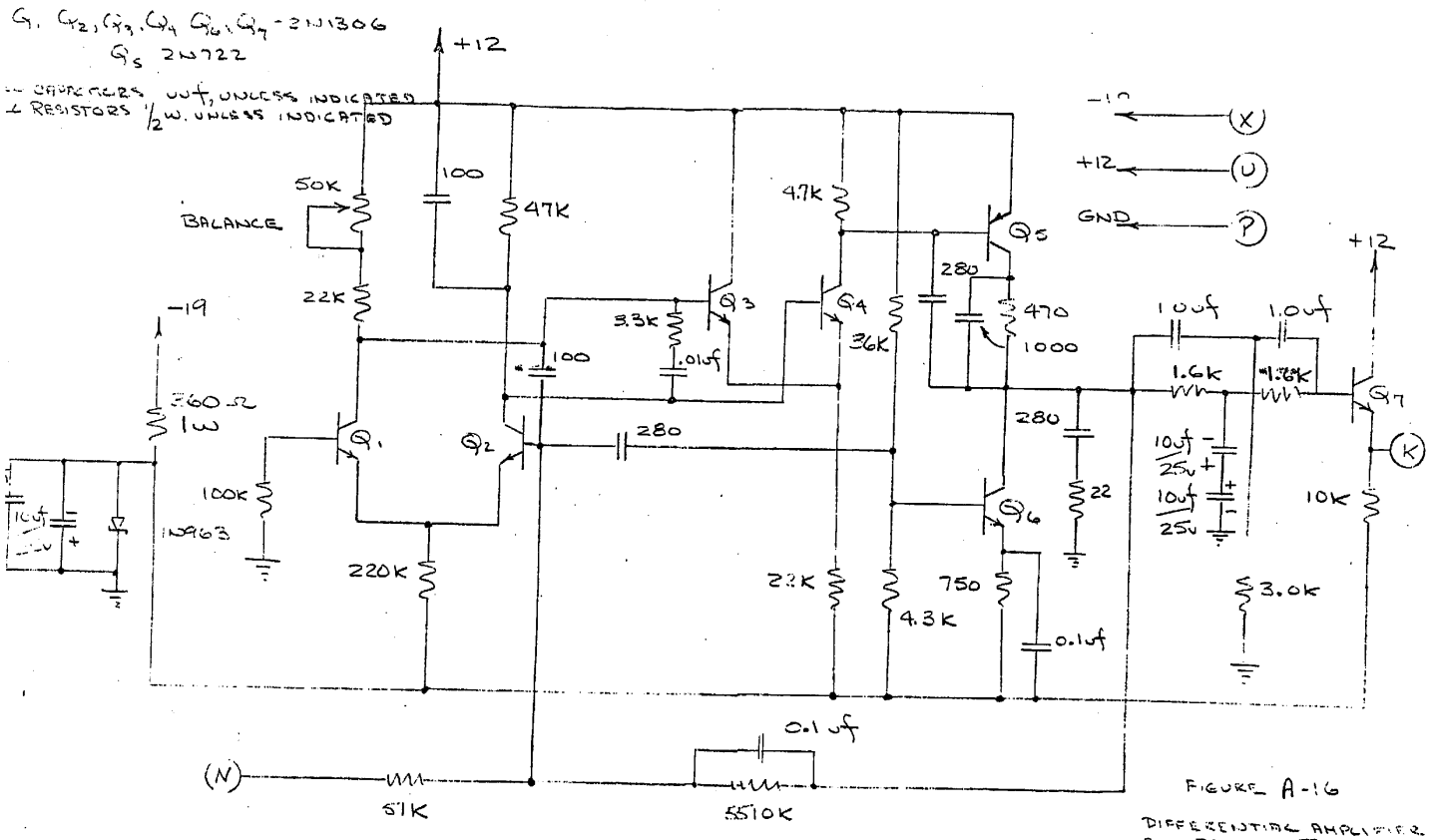


FIGURE A-16

DIFFERENTIAL AMPLIFIER AND PARALLEL T REJECTION NETWORK, CIRCUIT BOARD PR366(-), SCHEMATIC DIAGRAM

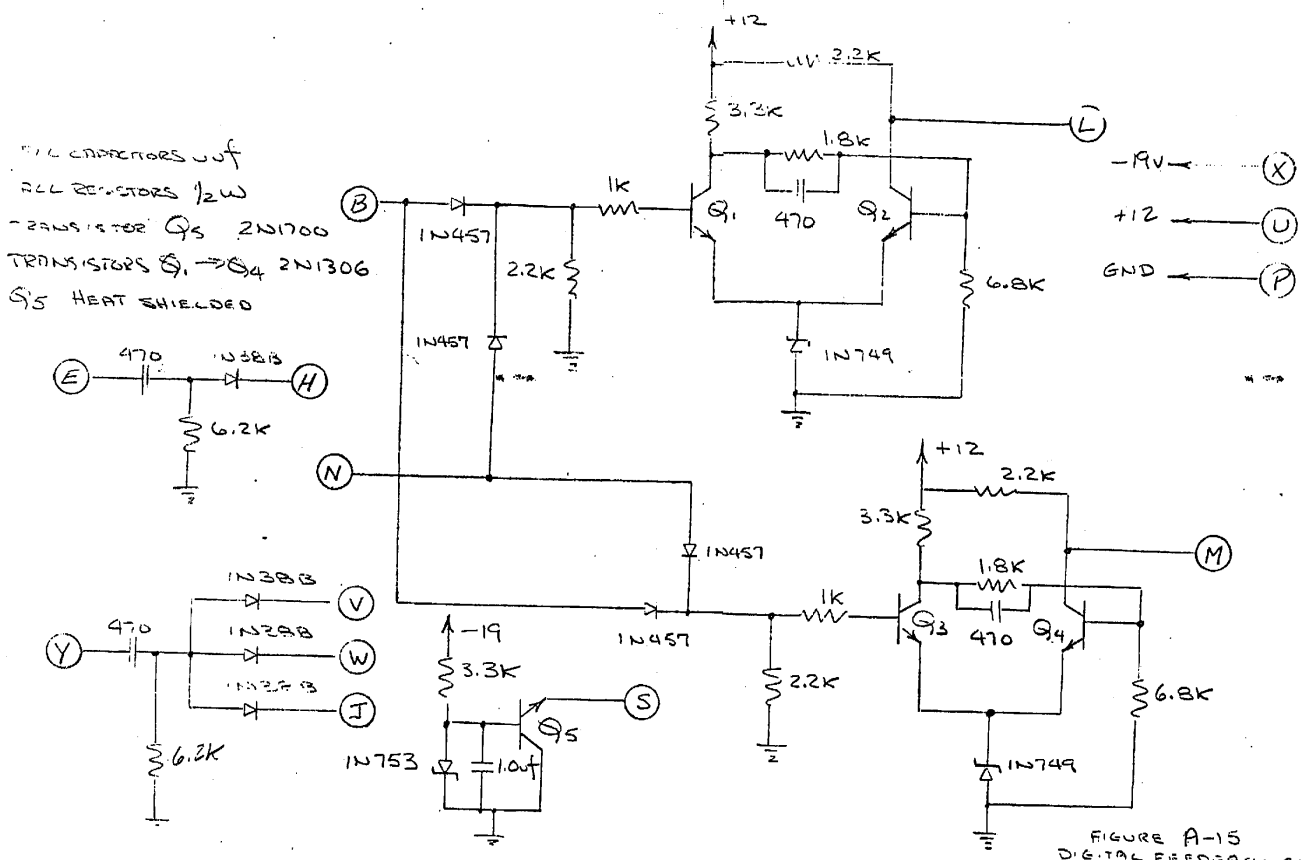


FIGURE A-15
DIGITAL FEEDBACK CONTROL AND SCHMITT TRIGGERS, CIRCUIT BOARD PR36 C.C. FOR Y-AXIS SYNC SYSTEM
SCHEMATIC DIAGRAM

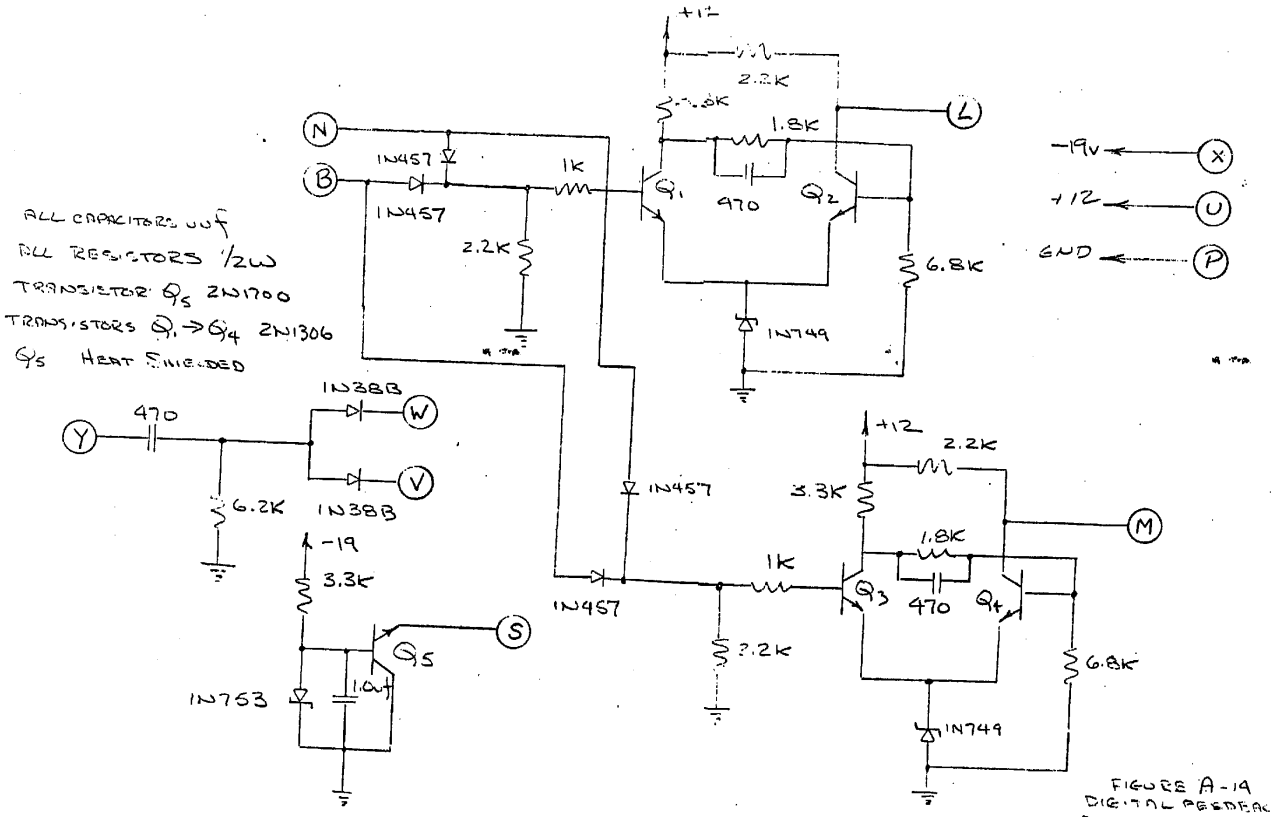
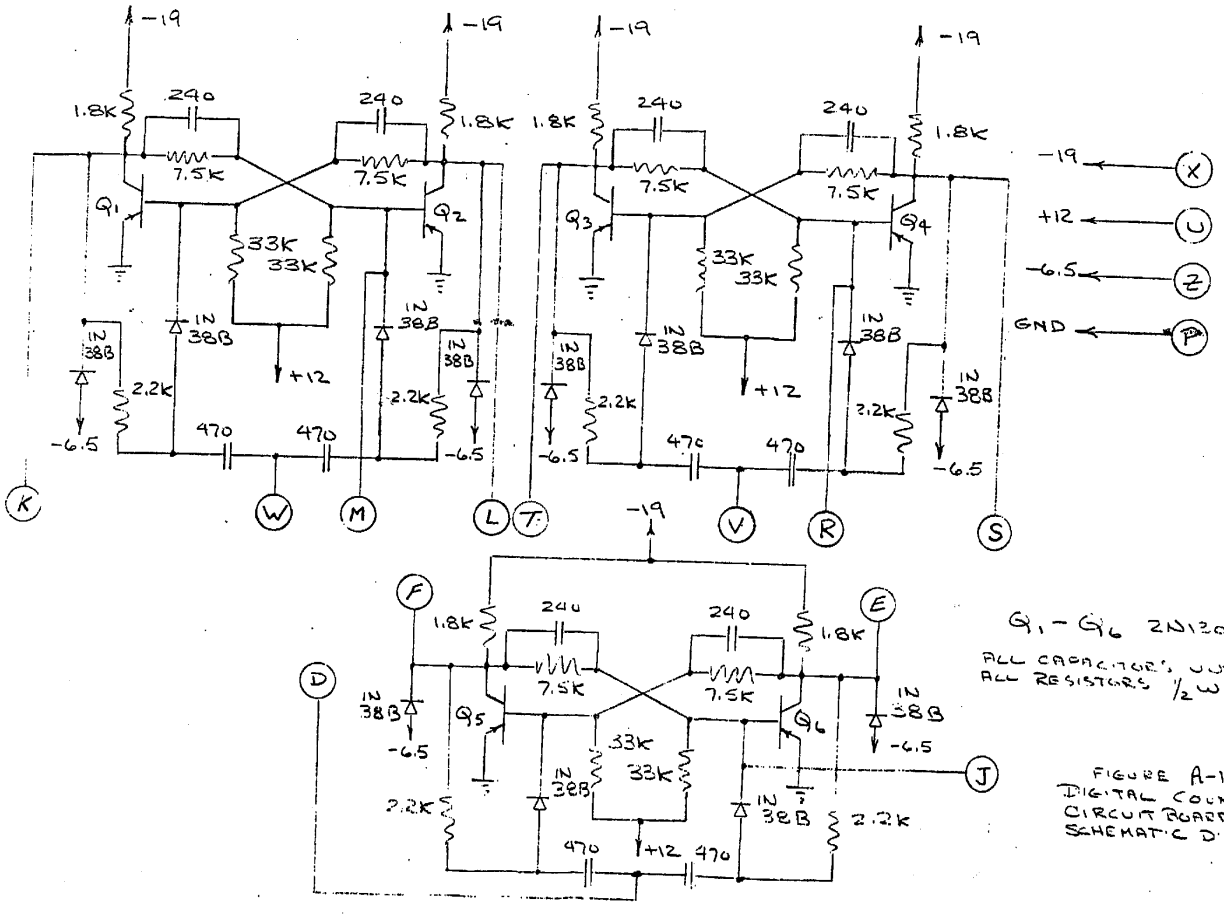


FIGURE A-19
DIGITAL FEEDBACK CONTROL AND SCHMITT TRIGGER CIRCUIT BOARD PC36C4
FOR X-AXIS SYNC SYSTEM, SCHEMATIC DIAGRAM



$Q_1 - Q_6$ 2N1207

ALL CAPACITORS, 10%
ALL RESISTORS 1/2 W

FIGURE A-13
DIGITAL COUNTERS
CIRCUIT BOARD 7R36C1
SCHEMATIC DIAGRAM